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The Basin Model:

SOCIAL SECTOR

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THE RIVER BASIN MODEL: SOCIAL SECTOR,

EPA

Project 16110 FRU 3/74

Envirometrics, Inc., Washington, D.C.

~~Water Pollution Control Research Series~~

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The RIVER BASIN MODEL is not primarily a water management model. Through human interaction and computer simulation, it represents the entire complex economic, social, and governmental activities taking place within a specified local system. Its users represent the major economic, social, and governmental decision-makers who cause a regional system to function and change on a year-to-year basis. As part of the functioning of this regional system, water is demanded by industries and municipal water suppliers and pollution is generated by manufacturing and commercial activities, by people, and by farm activities. The model is a computer-assisted decision-making tool in which computer programs simulate the major processes. Its users provide inputs to these programs on behalf of business activities in the Economic Sector, groups of people or population units in the Social Sector, and government departments in the Governmental Sector. A gaming format is employed. Decision-makers in the Social Sector represent the citizens living and working in the simulated area, voters who concern themselves with employment, housing, schools, parks, the quality of life and the character of the region in which they live. Water decisions are placed within their realistic context of having different importance to different individuals as a function of their occupation, location, resources, and personal inclinations. (Bell-Cornell)

*Social needs, *Social values, *Population, *Water users, *Water demand, *Water pollution control, *Treatment, *Regional analysis, *Simulation analysis, *Decision making, *Computer programs, *Mathematical models.

*Social assets, *Gaming-simulation.

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Janet Bell | Cornell

The RIVER BASIN MODEL:

Social Sector

by

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1100 17th Street, N.W.
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for the
Office of Research and Monitoring
Environmental Protection Agency

Project #16110 FRU
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I. INTRODUCTION TO THE MODEL

A. Brief Description of the Model

In a sense, the RIVER BASIN MODEL is a misnomer because if one places an emphasis on "River" it leads one to believe that the model is primarily concerned with water management. The emphasis should be placed on "River Basin", and that term should be interpreted in its broadest context as meaning a geographical area of land. Through its two major components -- human interaction and computer simulation -- the model represents the economic, social and governmental activity that takes place within the geographical boundaries defined by the river basin or more simply by a group of continguous counties.

The model is unlike most other simulation or human interaction models. It was not designed to accomplish any one specific purpose. Rather it was designed to let its users represent the major economic, social, and governmental decision-makers who cause a regional system to function and change on a year-to-year basis. As part of the functioning of this regional system, water is demanded by industries and municipal water suppliers and pollution is generated by manufacturing and commercial activities, by people, and by farm activities.

The model is a computer-assisted decision-making tool, in which a number of computer programs simulate major processes that take place in the local system such as migration, housing selection, employment, transportation, shopping patterns, the allocation of leisure time, and water quality determination. Users of the model provide inputs to these programs on behalf of business activities in the economic sector, groups of people or population units in the social sector, and government departments in the government sector.

Normally, the users of the model are assigned decision-making responsibility for businesses, population units, and government departments in a gaming format. This means that users become members of teams that are assigned control of:

1. Economic Assets: cash, land, manufacturing plants, outside investments, commercial activities, and/or residences.

2. Social Assets: population units that are designated as high income, middle income, and/or low income.

3. Government Assets: power of the budget, taxing and assessing authority, service responsibility, and planning and regulatory power.

The computer print-outs for a year provide a detailed description of the regional area represented by the model, and the users of the model evaluate this status as individuals, as team members, and collectively to define problems, establish objectives, develop strategies, implement plans, and react to feedback from the new computer printout for the next year.

The initial starting position shows a particular set of allocations of the locals system's resources and their effects on the status of the local area. The users of the model evaluate their own particular status within the local system as well as the status of the area as a whole. They then interact with one another in a dynamic decision-making environment in which they collectively have control over the local water quality decisions that will be made, implemented, and reacted to. Some of the model players may have apparently only marginal interests in the local water quality issues because they are pre-occupied with running schools, building roads, earning incomes, producing manufactured goods, building housing, and supplying local goods and services. Others will have maybe more interest as they attempt to be elected into public office, run the planning department, collect taxes, recreate, and develop a generally pleasant environment for their new residential subdivisions. Still others might have a direct and pressing interest in the local water quantity and quality as they attempt to set and enforce water quality standards, supply municipal water, use surface water in their production process, and benefit from major water-based recreation areas.

In short, the entire local system is represented by the model and its users, and water decisions are placed within their realistic context of having different importance to different individuals as a function of their occupation, location, resources, and personal inclinations.

B. The Three Sectors

The model contains three basic decision-making sectors: economic, social and public. (Figure 1) Every city or region contains these three vital sectors whose interactions cause the area to function and to either grow and prosper or stagnate and decay. Decisions made by one group ultimately affect others

Figure 1

THREE DECISION-MAKING SECTORS AND CONSTITUENT TEAMS

ECONOMIC TEAMS
(Identified by single letter codes: A, B, C, etc.)

INDUSTRIAL DECISION-MAKER

- HI-Heavy Industry
  - FL-Furniture and Lumber
  - SG-Stone Clay and Glass
  - MP-Primary Metals
  - MF-Fabricated Metals
  - NL-Nonelectric Machinery
  - EL-Electric Machinery
  - TE-Transportation Equipment
- LI-Light Industry
  - FO-Food
  - TA-Textiles and Apparel
  - PA-Paper
  - CR-Chemicals, Plastics and Rubber
- NS-National Service

COMMERCIAL DECISION-MAKER

- BG-Business Goods
- BS-Business Services
- PG-Personal Goods
- PS-Personal Services

RESIDENTIAL DECISION-MAKER

- RA-Single Family
- RB-Garden Apts. and Duplex
- RC-Multiple Unit and High Rise

GOVERNMENT TEAMS
(Identified by the specific code preceding the department name)

- CH-Chairman of Jurisdiction
- CO-Councilman
- AS-Assessment and Finance
- SC-School
- MS-Municipal Services
- UT-Gas, Electric, Water and Sewer
- HY-Highways
- BUS-Bus Company
- RAIL-Mass Transit Agency
- PZ-Planning and Zoning

SOCIAL TEAMS
(Identified by double letter codes: AA, BB, CC, etc.)

- PH-High Income
- PM-Middle Income
- PL-Low Income

and one group often works against another group to achieve its goals. For example, proposed commercial developments by an economic group in a predominantly residential area can be blocked by residents of that area just as proposed changes by the government departments can be opposed by those participants in the economic or social sector.

1. The Economic Sector

Economic decision-makers are those businessmen who operate industrial, commercial, residential and farm establishments. Upon receiving output at the beginning of the round economic decision-makers review their economic status and make decisions for the present round. The various economic activities in the model have the following characteristics:

Basic Industry

Heavy Industry, Light Industry and National Services spend money for business goods and business services, utilities, a labor force, transportation, and taxes. In order to produce basic industry output which is then sold to the national markets at prices determined by national business conditions (the computer), owners of basic industries can make a wide variety of decisions. These decisions include purchasing land, changing salaries or maintenance levels, boycotting business goods and business services establishments, acquiring laons, building new businesses, upgrading existing businesses, demolishing old ones, and treating effluents that are dumped into the local water system.

The basic industry of the economy can be further subdivided into the following categories:

HI - Heavy Industry

FL - Furniture and lumber
SG - Stone, clay and glass
MP - Primary metals
MF - Fabricated metals
NL - Non-electrical machinery
EL - Electrical machinery
TE - Transportation equipment

LI - Light Industry

FO - Food
TL - Textile, apparel and leather
PA - Paper
CR - Chemicals, plastics, and rubber

NS - National Services

Commercial Establishments

Business goods (BG) and business services (BS), personal goods (PG) and personal services (PS) spend money on many of the same items as basic industry in order to maintain a level of service capacity. This service capacity is consumed or partially consumed by local customers which include: the industrial sector, other commercial establishments and the population units (Pl's) who live in the city. Owners of the commercial establishments may make most of the decisions that owners of basic industries make in addition to setting prices for their products.

Residences

Single-family (RA), townhouse (RB), and high-rise (RC) residence units spend money on personal goods and personal services, utilities, and taxes, and earn income based on rent charged and the number and type of occupants residing in their housing units. Owners of residences may make the same types of decisions made by owners of basic industry in addition to setting the rent paid by their tenants.

Farms

Farm owners make very few decisions aside from how their land will be utilized and what level of fertilizer use they will employ.

2. The Social Sector

Decision-makers in the social sector represent the citizens who live and work in the simulated area. People are represented in terms of population units (Pl's). Each population unit represents fixed numbers of people (500). Population units are divided into three socio-economic groups: high income (PH), middle-income (PM) and low-income (PL). Because each class possesses its own expectations and behavioral patterns, each will have different preferences for residence, job, and schooling, etc. Social decision-makers can vote on behalf of the Pl's which they represent. Voting power is dependent upon the number of

population units controlled, the number of registered voters in each, and their socio-economic class. Social decision-makers can also direct the population units under their control to boycott places of employment or shop locations. Social decision-makers can also allocate leisure time of their population units to be spent in any of four basic activities: extra work, adult education (public or private), politics, and recreation. The amount of time spent on each of these activities has an effect on the socio-economic status and/or the dissatisfaction index of people living within the city.

A significant part of the model centers around how P1's function within the local system during the course of each round of play which represents one year of time in the local area. Figure 2 shows the actions of P1's as they are affected by the major operating programs.

3. The Public Sector

In the model, the government sector deals with the problems of education, highways, municipal services, planning, zoning, utilities, water supply and quality and bus and rail transportation. The public sector is divided into two basic components. The first component includes elected officials: the Chairman and the Council. These officials are elected by the social decision-makers representing the people who live in each jurisdiction. The Chairman and Council set tax rates, approve budgets, grant subsidies and appropriations, and make appointments. Appointed officials named by the Chairman are heads of these six governmental departments: Assessment (AS), Schools (SC), Municipal Services (MS), Highway (HY), Planning and Zoning (PZ), and Utilities (UT). The Bus and Rapid Rail Companies are semi-private organizations which also may be appointed by the Chairman. Players representing these departments make decisions which include allocating capital and current funds, changing salaries and maintenance levels, requesting federal-state aid, changing district boundaries, constructing or demolishing public buildings, upgrading public buildings, changing levels of service, and transferring cash between accounts.

Figure 2

Example of How Population Units Are Affected by the Major Operating Programs of the Model

Major Operating Programs	Effect on Population Unit
Migration	Pl's move to the local system, find and change housing within the local system, leave the local system
Water System	Poor water quality incareses dissatisfaction and high coliform count increases health costs and time lost due to illness.
Depreciation	Housing that depreciates becomes less attractive in the migration process.
Employment	Pl's are assigned to full and part time jobs that maximize net income (salary minus transportation costs), employers search for best educated workers.
Transportation	Pl's travel to work by the mode and route that minimizes total costs (dollar plus time), Pl's travel to shopping along the minimum cost routes.
School Allocation	Students of Pl's are assigned to public or private schools based upon the quality of public schools.
Park Allocation	Pl's are assigned to parks within a specified distance of where they live.
Time Allocation	Involuntary expenditures of leisure time are calculated as a function of the success of getting part time jobs, public adult education and the time spent on transportation.
Commercial Allocation	Pl's are assigned to stores at which the total costs are minimized (price plus transportation to the store).

C. The Water Component

The water component is a subsector that, in a sense, cuts across the other three sectors or is a part of each. For example, some of the industrial activities in the economic sector use surface water in their production process and all other economic businesses have some need for municipally supplied water. Population units in the social sector use water as a function of their income class and the type of housing they inhabit. In the government sector, the Utility Department is responsible for supplying the municipal water needs of the residents of its jurisdiction.

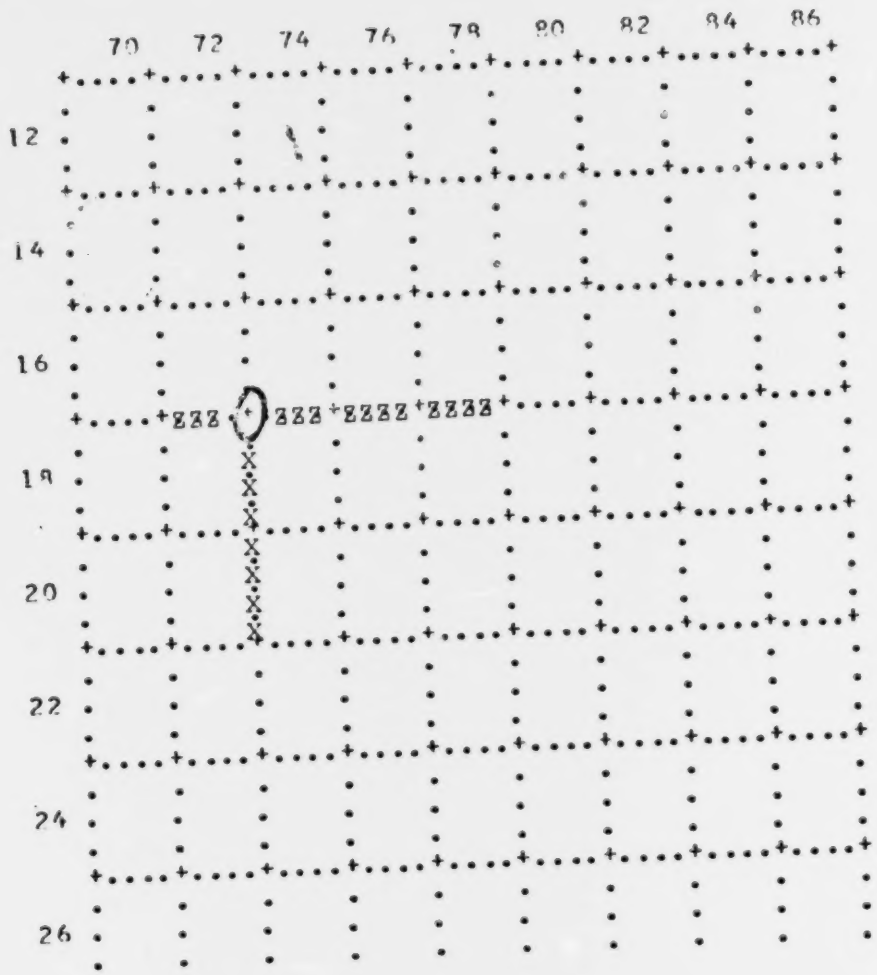
Each of the surface water users requires a specified quality of water and must either treat the water they intake or purchase water from a source outside of the local system. Every water user adds some pollutants to the water it returns to the water system. If left untreated, these water discharges may lower the quality of water of the body of water into which they are dumped. Since water users and polluters are located in a geographical space, acitivities upstream and downstream are affected differently by the dynamically created water quality conditions.

D. The Local System

The particular regional configuration being used is represented on a grid map consisting of 625 squares. Each square is of equal size and represents 6.25 square miles, 2.5 miles on a side. The grid and all of the computer maps are keyed to a coordinate system. Each parcel can be identified by its coordinates. Horizontal coordinates range from 70 to 118 and vertical coordinates from 12 to 60. Intersections are identified by the odd-numbered coordinates and highways are identified by even-odd (east-west) or odd-even (north-south) coordinates. In all cases, the horizontal coordinate (i.e., the larger number) is identified first.

For example, on the map in Figure 3 the shaded parcel is identified as 7014. Further, the four mile highway indicated by ZZZ is identified as 7217, 7417, 7617, 7817, while the two mile highway indicated by XXX is identified as 7318, 7320. The intersection marked by 0 is located at 7317.

Figure 3



E. The Unit of Time -- A Round

In the model, a round represents a year of change in the life of the simulated area. From the standpoint of the participants, however, a round may be thought of as a decision-making cycle which starts when they receive their computer output and ends when they hand in their decision input forms for processing by the computer.

During the early part of the typical round, decision-makers will be simultaneously reviewing their computer output and attempting to organize their possible actions. Economic decision-makers, for example, will probably attempt to acquire parcels of land that look good for future development purposes. They may attempt to secure loans from local or outside sources, apply for zoning changes, request utility expansions, and lobby for increased highway access. At the same time, social decision-makers might be bargaining for higher wages, requesting improvements in local schools and municipal services, lobby for higher water quality in the local river, and trying to promote those politicians who see things their way.

Meanwhile, the governmental decision-makers may be receiving requests from the economic and social decision-makers to lower taxes, improve schools, provide better municipal services, expand highways, build additional utilities, enlarge the park system, and improve other services. Budget officials are faced with the task of finding additional revenue to meet expanding public needs and dividing appropriations among the many local departments, all of which have attempted to justify their expanding budgets. Also the government office concerned with water quality might be pressuring the polluting industries to treat their wastes or face regulatory action. All water users might be concerned with water quality and quantity in so far as it affects their cost of using water and doing business.

Toward the middle of the round, it becomes clear to many decision-makers that all of their requests will not be granted. Thus, trade-offs and bargains must be made. Elected officials will begin to worry about staying in office. Departments must often plan to operate with less funds than they had requested. Low income representatives attempt to make their political power felt. High-income representatives attempt to maintain their status. Businessmen begin to look for short-cuts to reduce their losses and increase their activity and profit-making ventures. The water quality office begins to act upon its earlier threat.

As the round approaches a conclusion, the participants formalize the bargains they have made, continue to fill out their decision forms, terminate the negotiations on new wage levels, new prices and new rents, carry on their boycotts and complete any other possible actions. All water related decisions by the private and public decision-makers are completed. Treatment plants are built, industries shut down, fine levied, sampling stations constructed, etc.

When the round ends, participants campaign and carry out new elections, hold town meetings, debrief their actions, and develop new strategies while the computer performs its functions and prepares new output on the status of the simulated city.

F. The Function of the Computer

In the model, players are able to exercise a number of decision alternatives. Only some of these will be communicated to the computer, the rest will be part of the constant communication, bargaining and negotiating carried out in the game-room itself.

The computer performs several major functions in the model.

First, it stores all the relevant economic, social and governmental statistics for the area; updates data when changes are made; and prints out yearly reports on the status of the local system and reports for the economic, social, and government decision-makers.

Second, the computer simulates the actions of the outside system. For example, the computer simulates both a national business cycle, the probabilities of federal-state aid and interest rates on most loans.

Third, the computer performs certain routine functions or processes that would be time-consuming if the players themselves were to perform them. For example, the computer assigns workers from population units to jobs under the assumption that workers will attempt to earn as much money as possible. Other processes include assessing all property, assigning buyers of goods and services to shop at particular commercial establishments, assigning children to public or private schools based upon the capacity and quality of the public schools, and assigning population units to residences based on their desirability. The computer also simulates the migration process which moves population units into, out of, and within the local system. It also measures all of the types of pollution at all points along the river system and calculates a comprehensive water quality index.

SOCIAL SECTOR

II. Introduction to the Social Sector

This manual contains the basic information and description of the model required by the Social Sector. It is assumed that the Model Overview and the Scenario descriptions have been read prior to the receipt of this manual.

Once the players comprising the Social Sector have become familiar with the model in general, the particular city being represented, and the workings of the local economic, social, and government system they will be able to bring their own imagination and initiative to bear on the operation of the Social Sector and the population groups they represent.

The Social Sector teams are given the opportunity and responsibility for determining how the local population will act within the local dynamic system and it will have the chance to use this opportunity in such a way as to satisfy self-established goals and/or to respond to pressures brought on it by the government sector, landlords, employers, and business community.

This Social Sector manual contains the following sections:

A. Social Sector Summary
B. Social Sector Functions
C. Social Sector Relationships

A. Social Sector Summary

The Social Sector represents and makes some decisions for the people in the local system represented by the model. In a sense, the decision-makers in this sector do more than represent the people, they are the people. To fulfill this position social sector participants make the continuing decisions related to the people's financial status; the allocation of their time; the degree of their political action with other groups; the hard choices they make related to boycotts, strikes and even civil disobedience.

In addition, the periodic control of power comes to the Social Sector in the election process. This sector has a balance of voting power and makes the vote decisions on elected officials, all public referenda (including bond issues), and public laws.

As in the real world, the Social Sector often has the feeling of impotence because of their very limited real economic assets and the frequent indifference of the government toward them.

It is possible however, for the Social Sector to create a very real impact on both the processes of government and the development of the region. This requires making the maximum use of the information available, a persistent and determined interaction with other sector decision-makers (a good offense) and the development and pursuit of well conceived strategies.

It is important for social decision-makers to gain a good understanding of their options in the model and then bring their own ideas and concepts to bear quite early by going beyond the mechanics of their roles.

B. Social Sector Functions

Social decision-makers are concerned with the interests of the local population, such as jobs, housing, schools, parks, recreation, the quality of life and the character of the region in which they live.

The Social Sector does not own physical assets and has only limited amounts of cash assets. The Sector does not control employment (except the ability to strike) and the people are all tenants of economic sector landlords.

However, all the people in the local system are represented by the individuals which make up the Social Sector. People (P) in the local system are represented and identified in units of population (P1), each representing 500 people. Population units are divided into 3 socio-economic classes. These are:

High Income	PH
Middle Income	PM
Low Income	PL

The distribution, by income class, of the people in the model at any point in time is portrayed in the Demographic and Economic Statistics output and in the Socio-Economic Distribution Map.

Social Sector decision-makers have the function of representing and pursuing the interests, aspirations and attitudes reflected by a wide range of incomes, political strength, education levels, and geographic locations.

Participant roles may be structured precisely along income level lines or the roles may include mixed income classes. The challenge of adequately representing people by class interest is apparent.

Each social sector participant must, over time, make a decision on how he intends to pursue his individual role. The choices range all the way from being a "loner" to becoming committed to some group or bloc such as a union, citizen group, social sector neighborhood organization, income class caucuses, or political party.

As in other sectors, it is expected that social sector participants will enrich the operation of the model by bringing their experience, imagination, concepts and interests to bear on their roles.

Social decision makers are identified by double alpha characters: AA, BB, CC, etc.. Economic decision-makers are identified by single letters: A, B, C, etc.

C. Social Sector Relationships

System Interrelationships

The model operates on the interrelated activities and decisions of the three sectors.

The Economic Sector - businessmen who operate industrial, commercial and residential establishments

The Government (Public) Sector - elected and appointed officials concerned with education, highways, planning, zoning and all the public services

The Social Sector - representing the people and their varied interests and priorities.

Social Sector Relationships

The relationships among the elements and functions of this sector are portrayed in Figure SS-1.

Additional information on elements such as population characteristics, dissatisfaction and migration are in the Master Tables.

Computer Relationship

There are numerous phenomena that take place in the local system which are handled by the computer programs. Although all of these programs affect the local population in one way or another, several of the most important ones are described below.

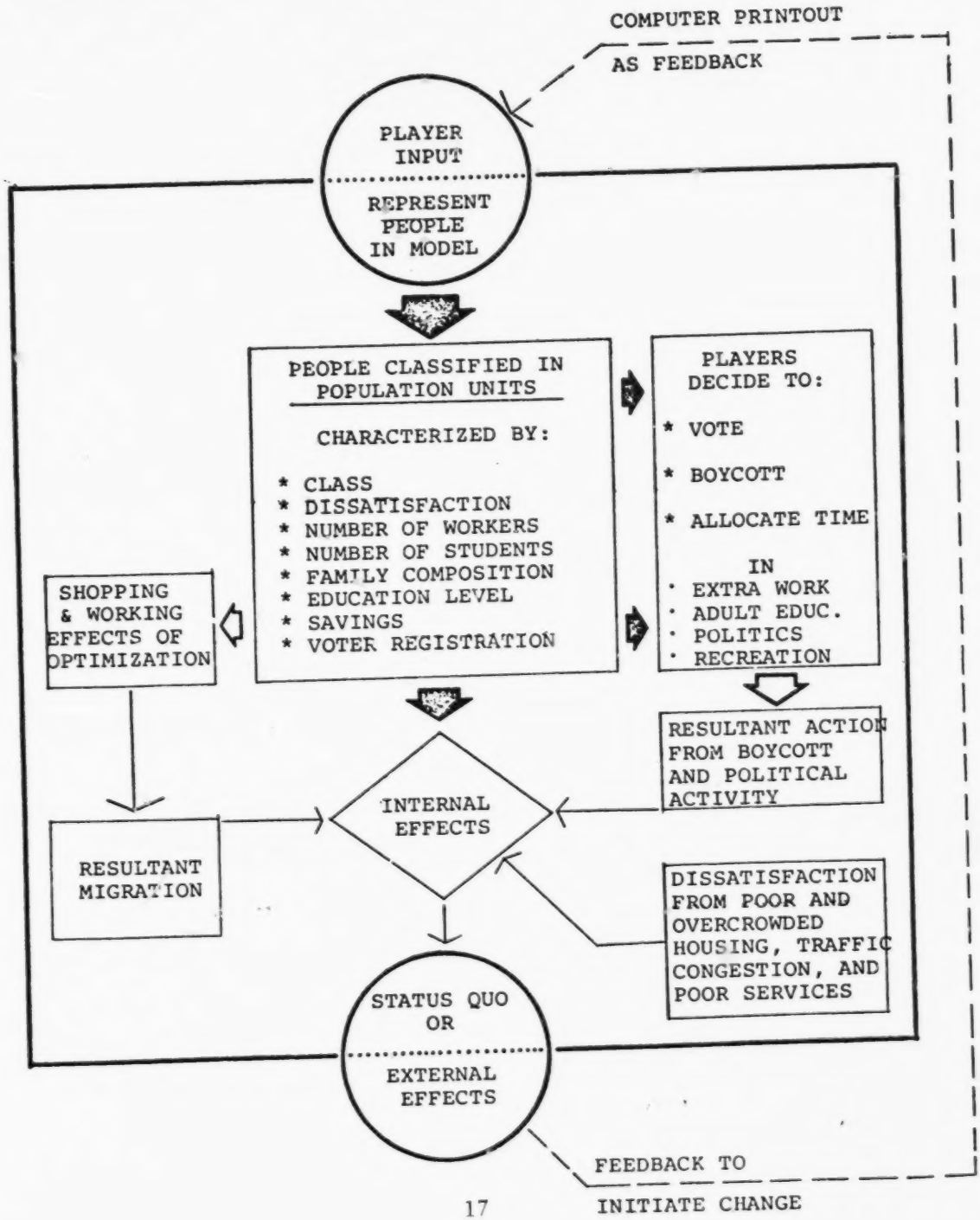
Migration

Migration is thought of in two ways in this model; first, people move in and out of the system and second, people moving within the system.

Movement is a function of a number of factors and these factors are different depending upon the type of migration. If people can afford it, they are apt to move away from poorly maintained housing in bad neighborhoods. With the exception population movements that occur because of new jobs in other cities, personal problems or other more or less random happenings, people tend to move because they are in some way dissatisfied with where they are living. Measuring a concept like "dissatisfaction" however is quite difficult. To accomplish this, at least for purposes of this model, several dissatisfaction or quality of life indexes have

Figure SS-1

SOCIAL SECTOR



been constructed. These are shown in Figure SS-2.

Internal Migration: Internal migration means the movement of population units from one set of housing structures to another within the local system. In every case the transfer entails a selection of a housing unit with a lower environmental index. The factors which make up this index include the housing quality index, the school quality, the municipal service quality, the taxes in the jurisdiction, the rent and the pollution index.

External Migration: In addition to those population units with the high quality of life indexes who cannot find better local housing, a certain percentage of those population units who are unable to find jobs (the unemployed) or jobs at their level (the underemployed) in the local system will become outmigrants.

Migration into the System: The movement of people into the system is a factor which the Social Sector is able to do very little about alone. In addition to a certain number of population units who move into the system for random factors, there is a factor used by the model to measure the attractiveness of the local system. This is the number of job openings by class (constrained by housing availability).

Employment Allocation

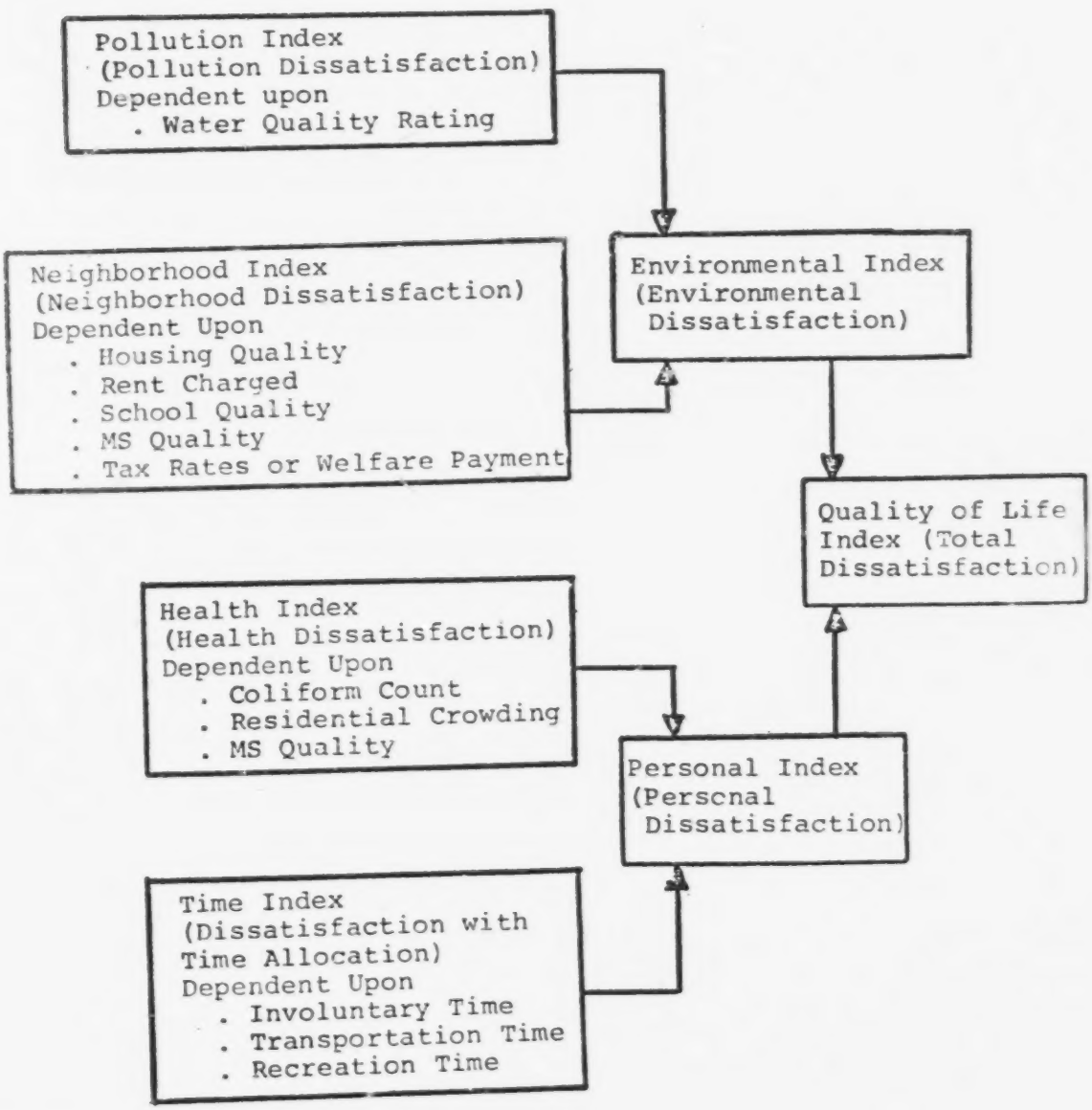
Employees are essential to the functioning of all non-residential activities in the economic sector and to the SC, MS, and transit companies in the Government Sector. These employees are hired from the population units which inhabit the simulated area. The number of workers in a given population unit is related to the population unit's class (high, middle, or low). Socio-economic class also determines the salary range which is paid to a worker.

Each commercial and industrial activity has a different employment requirement which describes the number and socio-economic mix of full-time and part-time employees necessary to produce the maximum amount of output (for industry) or capacity units (for commercial establishments).

Economic decision-makers do not voluntarily choose the employees that they hire and fire. Each round, the computer assigns population units to work locations by means of the Employment Process. This process optimizes employment by assigning people to work at places where their net salary (i.e., base salary minus transportation costs to work) is maximized. Furthermore, the best educated workers are assigned to jobs first.

Figure SS-2

COMPONENTS OF THE QUALITY OF LI"E INDEX



In general, the employment process will assign PH workers to high-income jobs, PM workers to middle-income jobs, and PL workers to low-income jobs. However, if there are shortages of jobs for any of the respective classes, population units may become employed at lower class levels. For example, if there are not enough high-income positions available, PH workers will be the first selected to fill middle-income positions and receive middle-income salaries. There is also a built-in bias for workers to continue to work at previous places of employment.

The Commercial Process

In the Commercial Process, economic and social sector purchasers of goods and services are assigned by the computer to commercial establishments on the basis of least total price (i.e., price charged plus transportation costs). In the Commercial Process there is a built-in bias for buyers to shop at the same establishment as in the previous round. Further, there is also a bias against shopping in overcrowded establishments, and shopping will not be done at establishments that are being boycotted by particular population units of a social team.

Housing Selection

Economic decision-makers own three types of residences (RA, RB, RC) in the local system. Owners of residences earn income by charging prices (i.e., rents). The number of population units which can live in a given residence depends on its type and its level of development. The quality index for residences indicates the physical conditions of the housing; the higher the quality index (0-100), the better the conditions. Further, the quality index and the amount of overcrowding affect whether or not a particular socio-economic class moves into a given residence.

III. COMPUTER PRINTED OUTPUT DESCRIPTION

A. Introduction

The printed computer output provides a yearly report of the status of the simulated region and of interactions within the region during the previous year. There are several types of output: maps showing characteristics of the region which differ geographically; summaries which present information in capsulated form; and detailed information from which the summaries are derived.

The figure on the next page shows the titles of the output sections in the order in which they are printed. That sequence follows neither the logical order of computer program operations nor the usual sequence in which a user examines the output. The code number beside the title of each section of output listed in this figure is the code number used in all examples of output included in this manual. The output is explained in this section in order of most general to most detailed information. Output is explained in the following order:

- maps
- summary information
- general information of relevance to all three sectors
- social sector detail
- economic sector detail
- government sector detail

There are a few standard features of all printed output sections. Each has a title which is a short description of the type of information given by the section of output. Each also contains both the round number and the game heading (the name of the data base being used or some other heading input by the director). Where relevant, a jurisdiction number is also printed.

After a few rounds' experience with the model, a model user usually needs only the printed computer output from a round and the Master Tables and input formats contained in this manual in order to play subsequent rounds.

RIVER BASIN MODEL OUTPUT

1. Migration
   - 1.1 Environmental Indexes
   - 1.2 Personal Indexes
   - 1.3 Dissatisfaction Cutoffs
   - 1.4 Migration Detail
   - 1.5 Migration Statistics
   - 1.6 Migration Summary
2. Water System
   - 2.1 Water User Effluent Content
   - 2.2 River Quality During Surface Water Process
   - 2.3 Water User Costs and Consumption
   - 2.4 Coliform and Pollution Index Values
3. Employment
   - 3.1 Employment Selection Information for PL Class
   - 3.2 Employment Selection Information for PM Class
   - 3.3 Employment Selection Information for PH Class
   - 3.4 Part-Time Work Allocation for PL Class
   - 3.5 Part-Time Work Allocation for PM Class
   - 3.6 Part-Time Work Allocation for PH Class
   - 3.7 Employment Summary
4. Commercial Allocation
   - 4.1 Personal Goods Allocation Summary
   - 4.2 Personal Services Allocation Summary
   - 4.3 Business Goods Allocation Summary
   - 4.4 Business Services Allocation Summary
   - 4.5 Government Contracts
   - 4.6 Terminal Demand and Supply Table
   - 4.7 Terminal Allocation Map
5. Social Sector
   - 5.1 Dollar Value of Time
   - 5.2 Social Decision-Maker Output
   - 5.3 Social Boycotts
6. Economic Sector
   - 6.1 Farm Output
   - 6.2 Residence Output
   - 6.3 Basic Industry Output
   - 6.4 Commercial Output
   - 6.5 Economic Boycott Status
   - 6.6 New Construction Table
   - 6.7 Land Summary
   - 6.8 Loan Statement
   - 6.9 Financial Summary
7. Social and Economic Summaries
   - 7.1 Number of Levels of Economic Activity Controlled by Teams
   - 7.2 Employment Centers
   - 7.3 Economic Control Summary for Teams
   - 7.4 Social Control Summary for Teams
   - 7.5 Social Control Summary Totals
   - 7.6 Economic Graphs for Teams
   - 7.7 Social Graphs for Teams
8. Government Detail
   - 8.1 Assessment Report
   - 8.2 Water Department Reports
   - 8.3 Sampling Station Report: Point Source Quality
   - 8.4 Sampling Station Report: Ambient Quality
   - 8.5 Utility Department Report
   - 8.6 Utility Department Finances
   - 8.7 Municipal Services Department Report
   - 8.8 Municipal Services Department Finances
   - 8.9 Municipal Services Department Construction Table
   - 8.10 Planning and Zoning Department Report
   - 8.11 School Department Report
   - 8.12 School Department Finances
   - 8.13 School Department Construction Table
   - 8.14 Highway Department Finances
   - 8.15 Highway Department Construction Table
   - 8.16 Rail Company Report
   - 8.17 Bus Company Report
   - 8.18 Chairman Department Finances
   - 8.19 Tax Summary
   - 8.20 Financial Summary
9. Summary Statistics
   - 9.1 Demographic and Economic Statistics
10. Maps
    - 10.1 Personal Goods Allocation Map
    - 10.2 Personal Services Allocation Map
    - 10.3 Business Commercial Allocation Map
    - 10.4 Municipal Service Map
    - 10.5 School Map
    - 10.6 Utility Map
    - 10.7 Water Usage Map
    - 10.8 Water Quality Map
    - 10.9 Municipal Treatment
    - 10.10 Municipal Intake and Outflow Point Map
    - 10.11 Surface Water Map
    - 10.12 Farm Runoff Map
    - 10.13 River Basin Flood Plain Map
    - 10.14 Farm Map
    - 10.15 Farm Assessed and Market Value Map
    - 10.16 Market Value Map
    - 10.17 Assessed Value Map
    - 10.18 Economic Status Map
    - 10.19 Highway Map
    - 10.20 Planning and Zoning Map
    - 10.21 Parkland Usage Map
    - 10.22 Socio-Economic Distribution Map
    - 10.23 Demographic Map
    - 10.24 Social Decision-Maker Map
    - 10.25 Topographical Restriction Map
    - 10.26 Government Status Map

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B. Map Output

The model output includes several maps which visually represent characteristics of the simulated region which differ by location. The entire simulated region is represented on a single, two-page computer map. A map key is printed at the bottom of each page. Map symbols appear on a map in the three types of locations which can be specified in the model: parcels (squares), parcel edges (lines separating squares), and intersections of lines (parcel corners). Land uses and other characteristics of parcels are represented within the squares. Divisions between parcels such as roads or jurisdiction boundaries are represented between parcels, and activities such as terminals are represented at parcel corners.

The Map Titles and a brief description of their contents are given below, in the order in which they will be discussed. All information is located spatially.

Economic Status Map: economic owners, economic activities and operating levels, zoning, levels of utilities installed, amounts of undeveloped land, road types, terminal levels, jurisdiction boundaries.

Government Status Map: school levels, parks, municipal service levels, utility plant levels, road types, terminal levels, jurisdiction boundaries.

Socio-Economic Distribution Map: residence types and levels, number of Pl's of each class, road types, terminal levels, jurisdiction boundaries.

Demographic Map: populations, residential quality indexes, business value ratios, percent occupancy, road types, terminal levels, jurisdiction boundaries.

Personal Goods Allocation Map: PG shopping location for each class and residence, PG location.

Personal Services Allocation Map: PS shopping location for each class and residence, PS location.

Business Commercial Map: BG and BS shopping location for each business, BG and BS locations.

Utility Map: utility units served, utility units installed, utility plants, utility district boundaries, jurisdiction boundaries.

Surface Water Map: volumes of surface water, rates of flow, land area in water, directions of surface water flow, lakes.

Municipal Treatment Plant Map: municipal water intake treatment plants and levels, municipal sewage treatment plant types and levels, utility plant locations and code numbers, directions of surface water flow, utility district boundaries, lakes.

Municipal Inflow and Outflow Point Map: Municipal surface water intake points, municipal sewage outflow points, utility districts served by each, surface water qualities, directions of surface water flow, utility district boundaries, lakes.

Water Quality Map: economic activities and operating levels, surface water qualities, directions of surface water flow, lakes.

Economic Sector Water Usage Map: economic activities and operating levels, amounts of recycling, business effluent treatment types and levels, utility district boundaries, jurisdiction boundaries.

Municipal Services Map: economic activities and operating levels, municipal service units required, municipal services and their use indexes, municipal service district boundaries, jurisdiction boundaries.

School Map: numbers of public school students, numbers of private school students, schools and their use indexes, school district boundaries, jurisdiction boundaries.

Highway Map: economic activities and operating levels, road types, terminal levels.

Planning and Zoning Map: zoning, park, public institutional land uses, road types, terminal levels, jurisdiction boundaries.

Parkland Usage Map: parks, populations served by park, park use indexes, road types, terminal levels, jurisdiction boundaries.

Market Value Map: market values of all non-farm land, privately owned buildings, and privately owned land and buildings, road types, terminal levels, jurisdiction boundaries.

Assessed Value Map: assessed values of non-farm privately owned land and buildings, road types, terminal levels, jurisdiction boundaries.

Farm Assessed and Market Value Map: assessed and market values of farms, amount of land in farms, road types, terminal levels, jurisdiction boundaries, lakes.

Farm Map: farm owners, amount of land in farms, farm types, levels of fertilization, road types, terminal levels, jurisdiction boundaries.

Farm Runoff Map: where runoff from farms flows, direction of surface water flow, lakes.

River Basin Flood Plain Map: river basins, dam priorities, flood susceptibility of each parcel, direction of surface water flow, lakes, jurisdiction boundaries.

Topographical Restriction Map: topographically undevelopable land, road types, terminal levels, jurisdiction boundaries.

Social Decision-Maker Map: social decision-maker controlling each class living on each residence parcel, road types, terminal levels, jurisdiction boundaries.

1. Economic Status Map

This map shows the economic sector owners of all privately-owned non-farm parcels and the economic activity, if any, on each parcel. A parcel can have only one economic owner and one economic activity. Owners of farm parcels are shown on the Farm Map. The types of economic activities represented in the model are listed in the Master Tables.

The economic owner of a parcel owns all of the land and developments on the parcel which do not belong to the government or which are not topographically undevelopable. If the economic owner sells land to another economic decision-maker, he must sell all of the privately-owned land and buildings on the parcel to the new owner. An economic decision-maker can sell any portion of undeveloped land on a parcel to a government department.

The Planning and Zoning Department may zone parcels. Zoning is a restriction on economic development. Once a parcel is assigned a particular zoning code, all new economic development on the parcel must conform to the new zoning. If a parcel is unzoned, there is no restriction on what type of activity may be constructed on it. The Economic Status Map key defines what private land uses are allowed under each zoning code.

When a new economic development is constructed on a parcel, it must not only conform to the parcel's zoning; it must have sufficient utility service. Utilities are installed by the Utility Department in "levels" (1 - 9). Each level of economic activity requires a certain number of utility units, and each level of utility service supplies a fixed number of utility units to a parcel.

If an economic decision-maker has insufficient utility service for a proposed development, the Utility Department must install adequate utility service before the new development can be constructed.*

---

*There are two exceptions to the utility restriction on development: 1) RA housing can be built with "private utilities", which do not require utilities supplied by the Utility Department; 2) the director can override the utility restriction on individual developments.

Figure 10.18

INOCITY
ECONOMIC STATUS MAP
PARCEL KEY
TOP LEFT: OWNER
TOP RIGHT: ZONING
MIDDLE: LAND USE AND LEVEL
BOTTOM LEFT: UTILITY LEVEL
BOTTOM RIGHT: % UNDEVLPD LAND
PARCEL EDGES
INTERSECTIONS
ZONING LAND USE
ZONING USE

Economic developments also require land. Each activity, depending on its type, requires a certain amount of land for each constructed level of development. Regardless of the operating level of an activity, the land consumed is that of the constructed level, which is always greater than or equal to the operating level. The amount of privately-owned land which is not in developments is classified on this map as undeveloped. If a parcel shows no undeveloped land, no further economic development can occur there unless the owner either acquires more land from a government department owning a portion of the parcel or demolishes existing economic developments. An economic decision-maker can acquire land by purchasing a parcel from another economic decision-maker or by bidding on land which is owned by the Outside.

The operating level of an economic activity is shown on the Economic Status Map. For most purposes, a business' operating level is the only level considered by the computer programs. However, a business pays property taxes and maintenance for its constructed level.

2. Government Status Map

Whereas there can be only one economic owner per parcel, any combination of government departments can own developed and undeveloped land on a parcel. The government departments which can own land, and the types of developments each can construct on a parcel are:

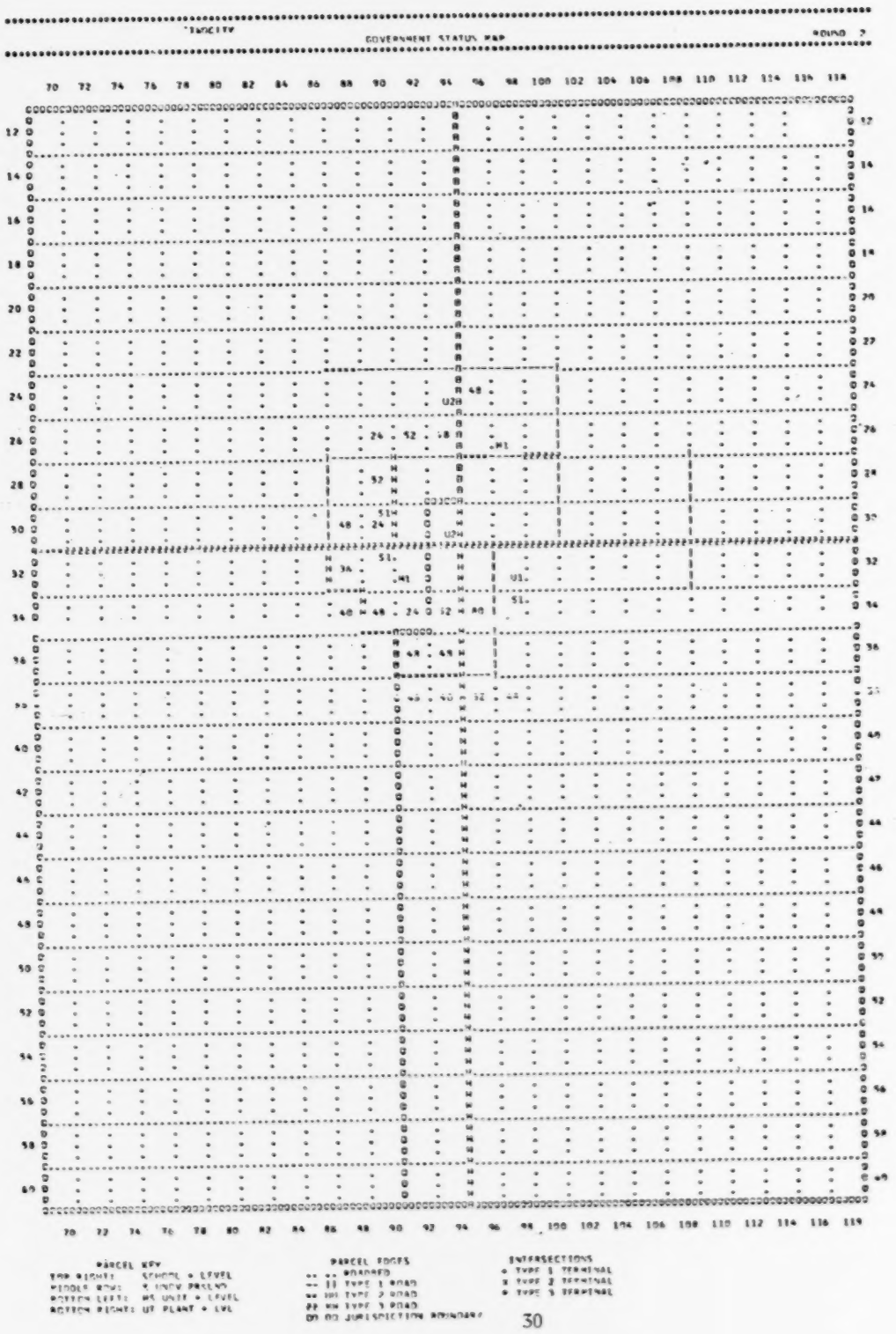
Department	Development Type
Utility Department	Utility Plant Water Intake Treatment Plant Sewage Outflow Treatment Plant: Chlorination Primary Treatment Secondary Treatment Tertiary Treatment
School Department	School Unit
Municipal Service Department	Municipal Service Unit
Planning and Zoning Department	Parkland Public Institutional Land
Highway Department	Road* Terminal*

A government department can sell undeveloped land which it owns to either another government department or to the economic decision-maker owning the privately-owned portion of a parcel.

The government status map shows the locations of some of the types of government activities: schools, parks, utility plants, and municipal service units.

*A road requires land from the parcels on each side, and a terminal requires land from the four parcels touching the intersection at which it is located.

Figure 10.26


GOVERNMENT STATUS MAP
ROUND 2
PARCEL KEY
PARCEL CODES
INTERSECTIONS

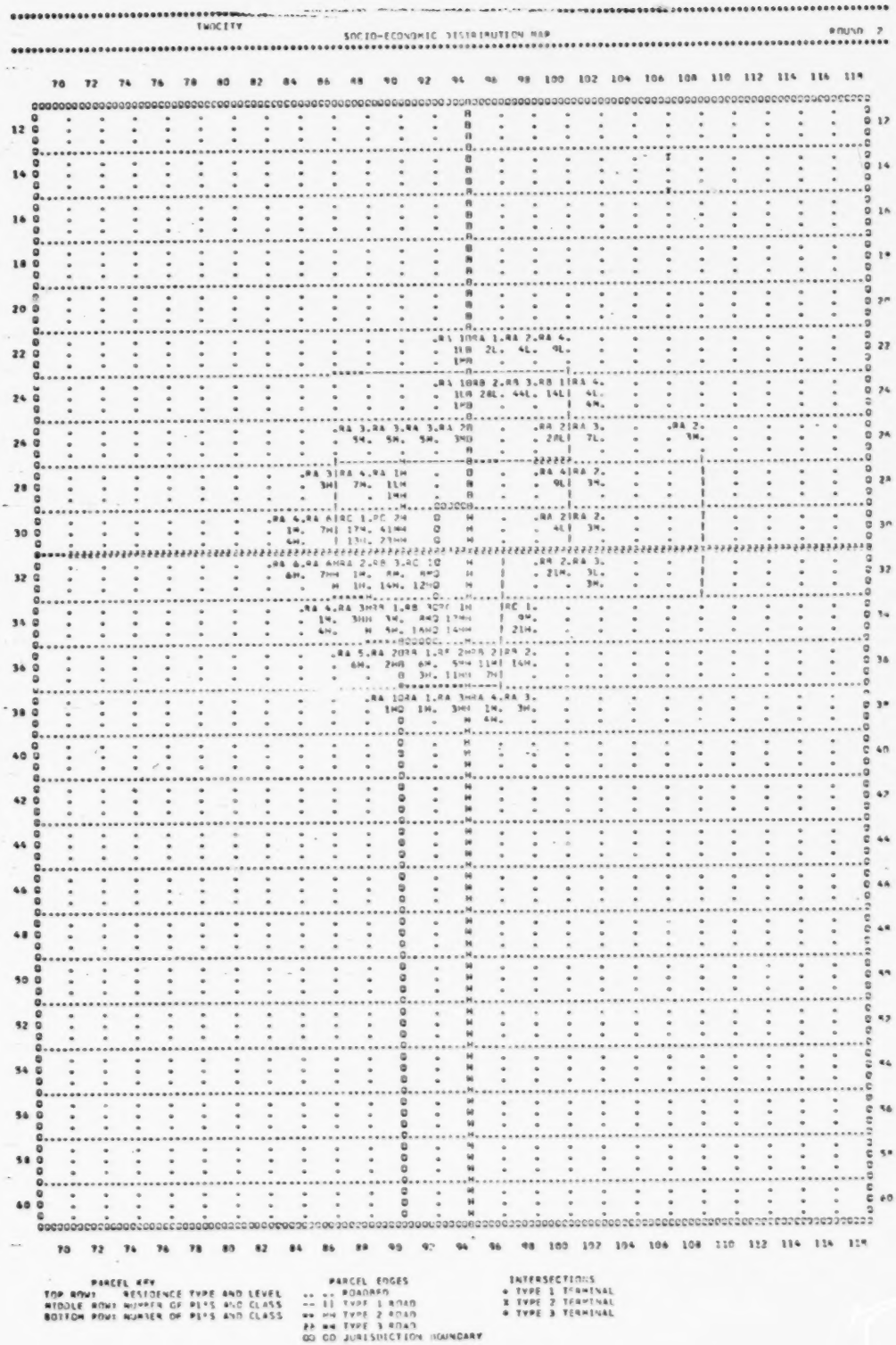
3. Socio-Economic Distribution Map

This map shows the number of P1's of each class living on each residence parcel. The residence type and level are also printed.

The migration process allocates people to housing. Only two classes can live on a residence parcel simultaneously, due in part to the model's restriction that a PH will not move into a residence with a quality index below 71 and a PL will not move into housing with a quality index above 70. It is possible, if a residence depreciates below the minimum that a class will accept, that high-income, for example, will live in a residence with a quality index below 71 if the class was living on the parcel before the depreciation. In no case, however, can PH's reside on the same parcel with PL's.

Each level of a residence type provides a fixed number of space units. A P1 occupies a fixed number of space units, depending on its class. The percent occupancy of each residence is shown on the Demographic Map.

Figure 10.22


TWOCITY
SOCIO-ECONOMIC DISTRIBUTION MAP
PARCEL KEY
TOP ROW: RESIDENCE TYPE AND LEVEL
MIDDLE ROW: NUMBER OF PLYS AND CLASS
BOTTOM ROW: NUMBER OF PLYS AND CLASS
PARCEL EDGES
-- -- ROADASS
== == TYPE 1 ROAD
== == TYPE 2 ROAD
TYPE 3 ROAD
OO OO JURISDICTION BOUNDARY
INTERSECTIONS
+ TYPE 1 TERMINAL
X TYPE 2 TERMINAL
* TYPE 3 TERMINAL

4. Demographic Map

The demographic map shows the number of people living on each residence parcel, the percent occupancy of each residence and the quality of all privately owned buildings and equipment.

Overcrowding (over 100% occupancy) contributes to a residence's neighborhood index and to the health index.

The quality is expressed as the quality index for a residence and as the value ratio for non-residential activities. A value ratio is the ratio of the present condition of a business' buildings and equipment to their original condition, expressed as a percent.

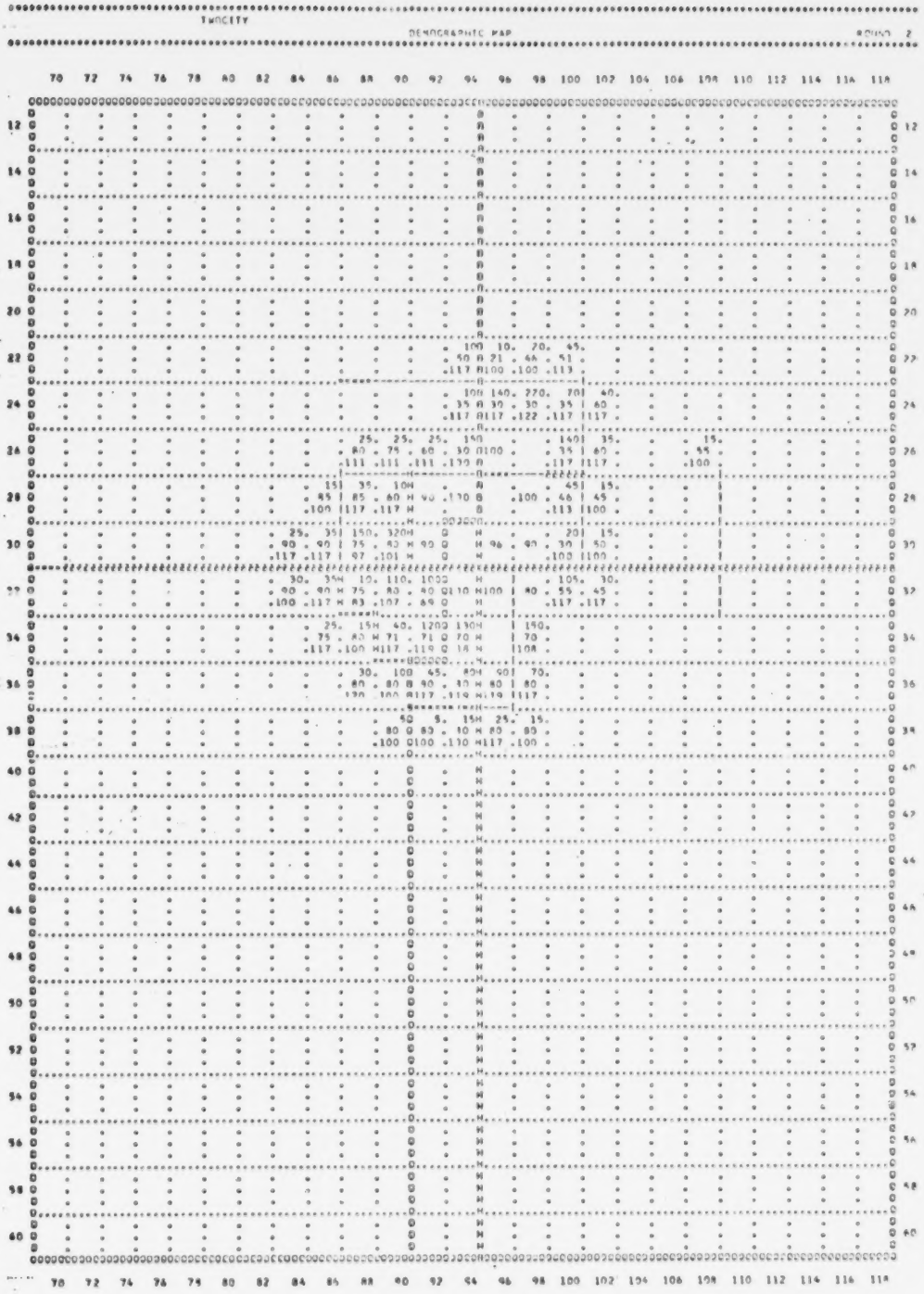
A quality index is somewhat different. Whereas a new business has a value ratio of 100, a new residence can have a quality index from 40 to 100.

Each year buildings and equipment depreciate in response to several conditions which vary by type of activity (see the Master Tables for the causes of depreciation). A business's depreciation is measured as a percent of original value (100). A residence's depreciation is measured as a percent of the original value of such a type of residence originally built at a quality index of 100, regardless of the original quality of the specific residence. Thus, business depreciation is a percent of original value but residential depreciation is a percent of quality index 100.

The owner of an activity can set a maintenance level for the activity. The maintenance level is the quality index or value ratio at which the owner will maintain the activity, regardless of how much it depreciates in a year. Not until the activity's value ratio or quality index falls to its maintenance level does the owner incur maintenance expenditures. The computer program depreciates and maintains buildings and equipment and charges the owner for the maintenance cost.

The Demographic Map shows quality indexes and value ratios after depreciation and after any maintenance.

Figure 10.23


TWNCITY
DEMOGRAPHIC MAP
ROWS 2
PARCEL KEY
TOP ROW: TOTAL POP IN 100'S (RES)
MIDDLE ROW: OI (RES) OR VR (NR)
BOTTOM ROW: E OCCUPANCY (RES)
PARCEL EDGES
.. .. ROADLESS
-- || TYPE 1 ROAD
== HH TYPE 2 ROAD
TYPE 3 ROAD
CO OO JURISDICTION BOUNDARY
INTERSECTIONS
+ TYPE 1 TERMINAL
X TYPE 2 TERMINAL
* TYPE 3 TERMINAL

5. Personal Goods Allocation Map

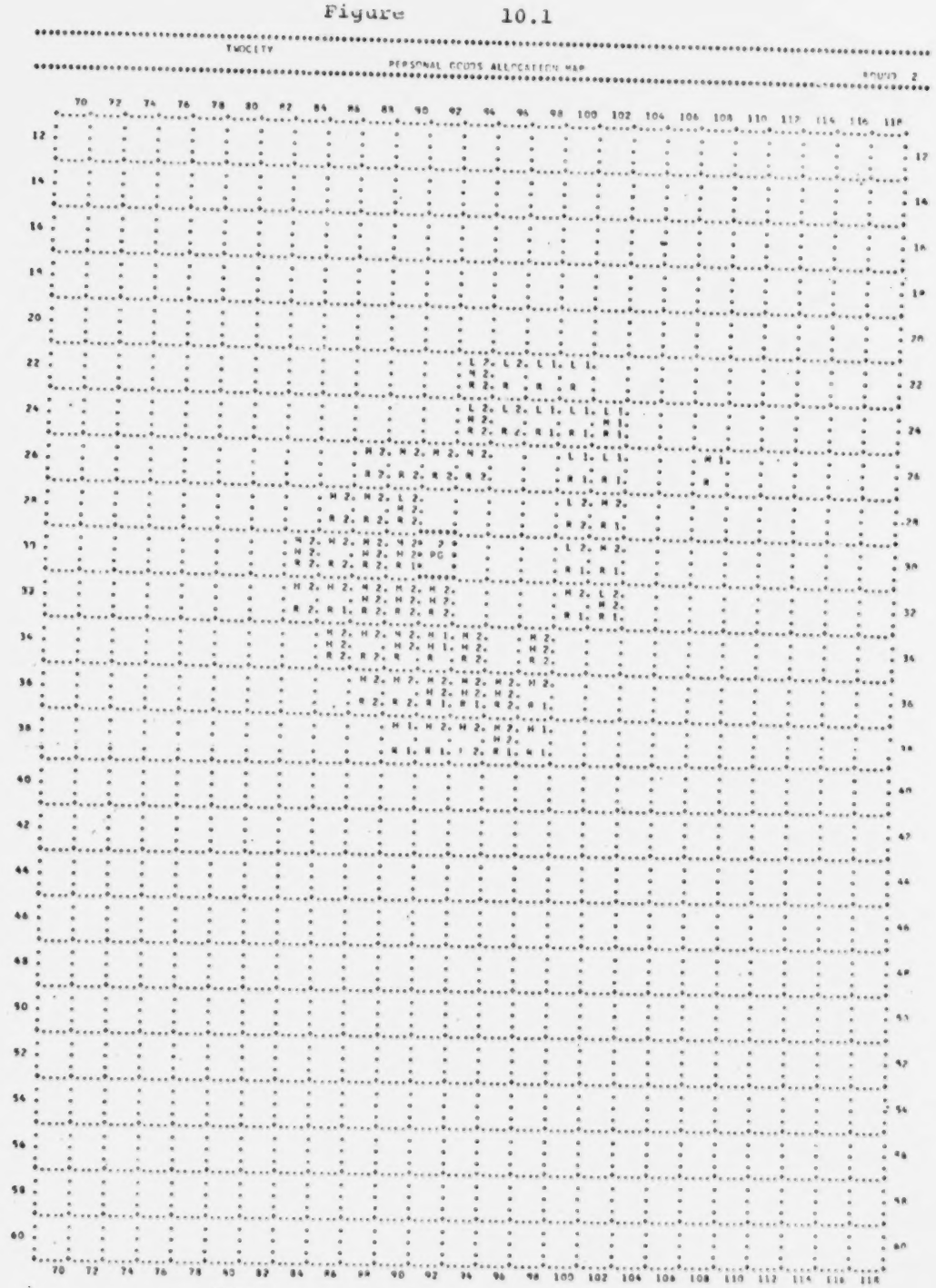
This map identifies the location of Personal Goods establishments and identifies the PG establishments that serve the customers from each parcel of land that has residences on it. PG establishments are located on those parcels that are encircled by asterisks. Their code number is also shown on the parcel where they are located.

It is possible to have up to three distinct customers on a parcel of residential land: population units from two classes and the residence landlord. No more than two classes of population may live on a single residential parcel. All population units purchase personal goods as part of their annual expenditures. All Pl's of a class on a parcel purchase their personal goods at a single PG establishment. Landlords purchase personal goods only if they make maintenance expenditures. Buyers are assigned to specific commercial activities taking into account the price charged, transportation costs to the store, the capacity of the store, and boycotts.

The four letter codes used within a parcel on the map are: L = low income, M = middle income, H = high income, and R = residence. One or two of the first three codes prints if population units live on the parcel. If no one occupies the housing, no income class code is printed. The number after the letter code is the PG establishment code. The outside Local system PG suppliers are identified sequentially as determined by their location. Establishments located on parcels as one reads the map from top to bottom and from left to right have the lowest code numbers. The identification number assigned to a particular PG establishment might change from round to round if new PG's are being constructed at locations that are scanned prior to the parcel on which that particular PG is located.

The buyer code "R" will print on every parcel that has a residence. If the landlord makes maintenance expenditures then the R is followed by a PG establishment code. No code after the R indicates that no maintenance is being performed on that residence parcel.

Figure 10.1


TMOCITY
PERSONAL GOODS ALLOCATION MAP
ROUND 2
PARCELS
TOP ROW: P1 CLASS AND SERVING PG
MIDDLE ROW: P1 CLASS AND SERVING PG
BOTTOM ROW: RESIDENCE AND SERVING PG
****** ASTERISCS IDENTIFY
* NN * LOCATION OF PG
* PG *
* * NN IS THE
****** CODE NUMBER

6. Personal Services Allocation Map

This map identifies the location of Personal Services establishments and PS establishment that serves the customers from each parcel of land that has residences on it. PS establishments are located on those parcels that are encircled by asterisks. Their code number is also shown on the parcel where they are located.

It is possible to have up to three distinct customers on a parcel of residential land: population units from two classes and the residence landlord. No more than two classes of population may live on a single residential parcel. All population units purchase personal services as part of their annual expenditures. All Pl's of a class on a parcel purchase their personal services at a single PS establishment. Landlords purchase personal services only if they make maintenance expenditures. Buyers are assigned to specific commercial activities taking into account price charged, transportation costs to the store, capacity of the store, and boycotts.

The four letter codes used within a parcel on the map are L = low income, M = middle income, H = high income, and R = residence. One or two of the first three codes prints if population units live on the parcel. If no one occupies the housing, no income class code is printed. The number after the letter code is the PS establishment code. The outside system suppliers are identified by the number code "1". Local system PS suppliers are identified sequentially as determined by their location. Establishments located on parcels as one reads the map from top to bottom and from left to right have the lowest code numbers. The identification number assigned to a particular PS establishment might change from round to round if new PS's are being constructed at locations that are scanned prior to the parcel on which that particular PS is located.

The buyer code "R" will print on every parcel that has a residence. If the landlord makes maintenance expenditures then the R is followed by a PS establishment code. No code after the R indicates that no maintenance is being performed on that residence parcel.

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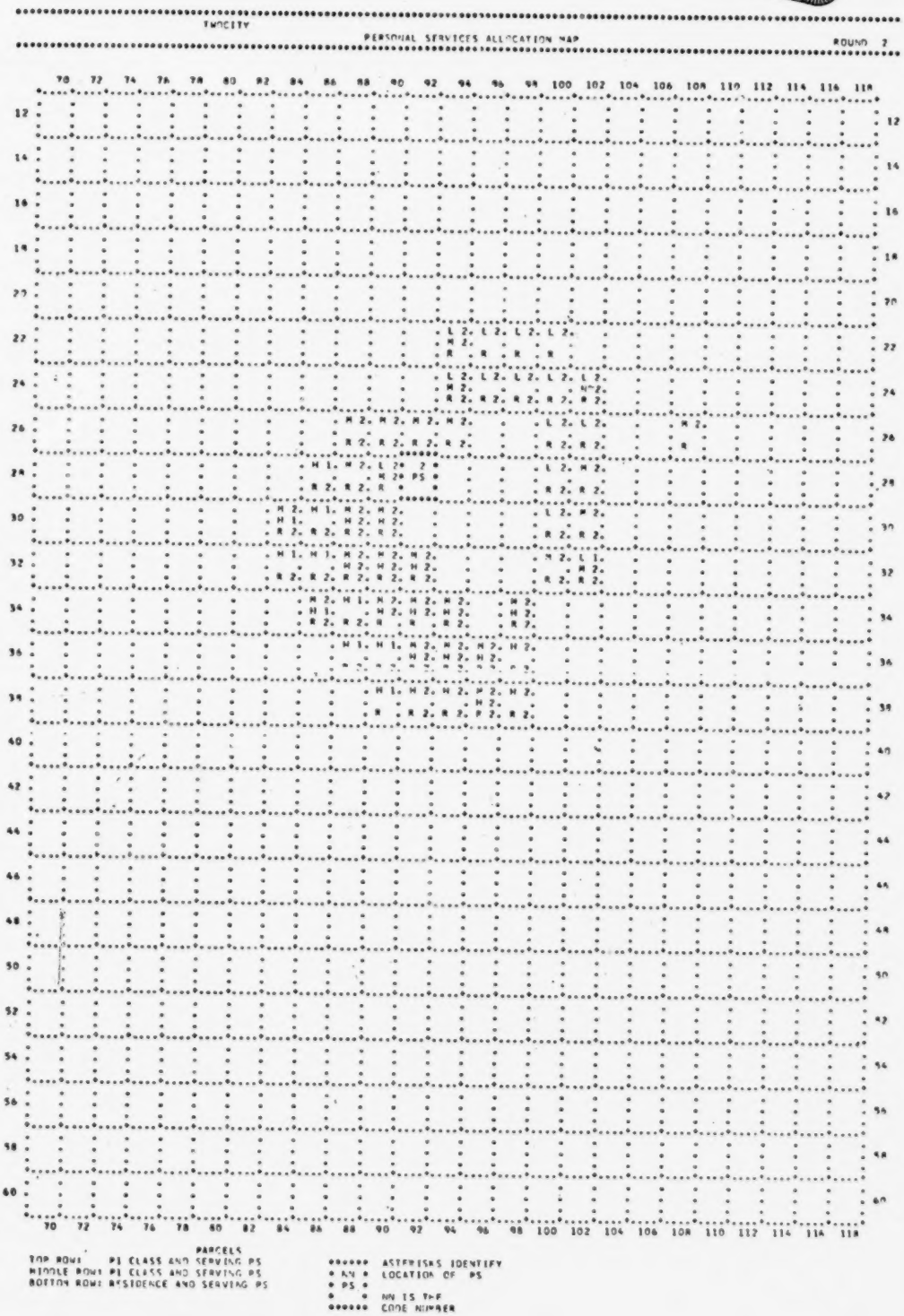
Figure 10.2



7. Municipal Treatment Plant Map

A Utility Department supplies water to all economic activities except some basic industries which obtain their own water from the surface water. Each utility district is also a water district. A parcel is supplied with municipal water and sewer service when utilities are installed on the parcel. The department can decide where to intake water, where to dump sewage, how much intake water it will provide, how much sewage treatment it will provide, and where treatment facilities will be located.

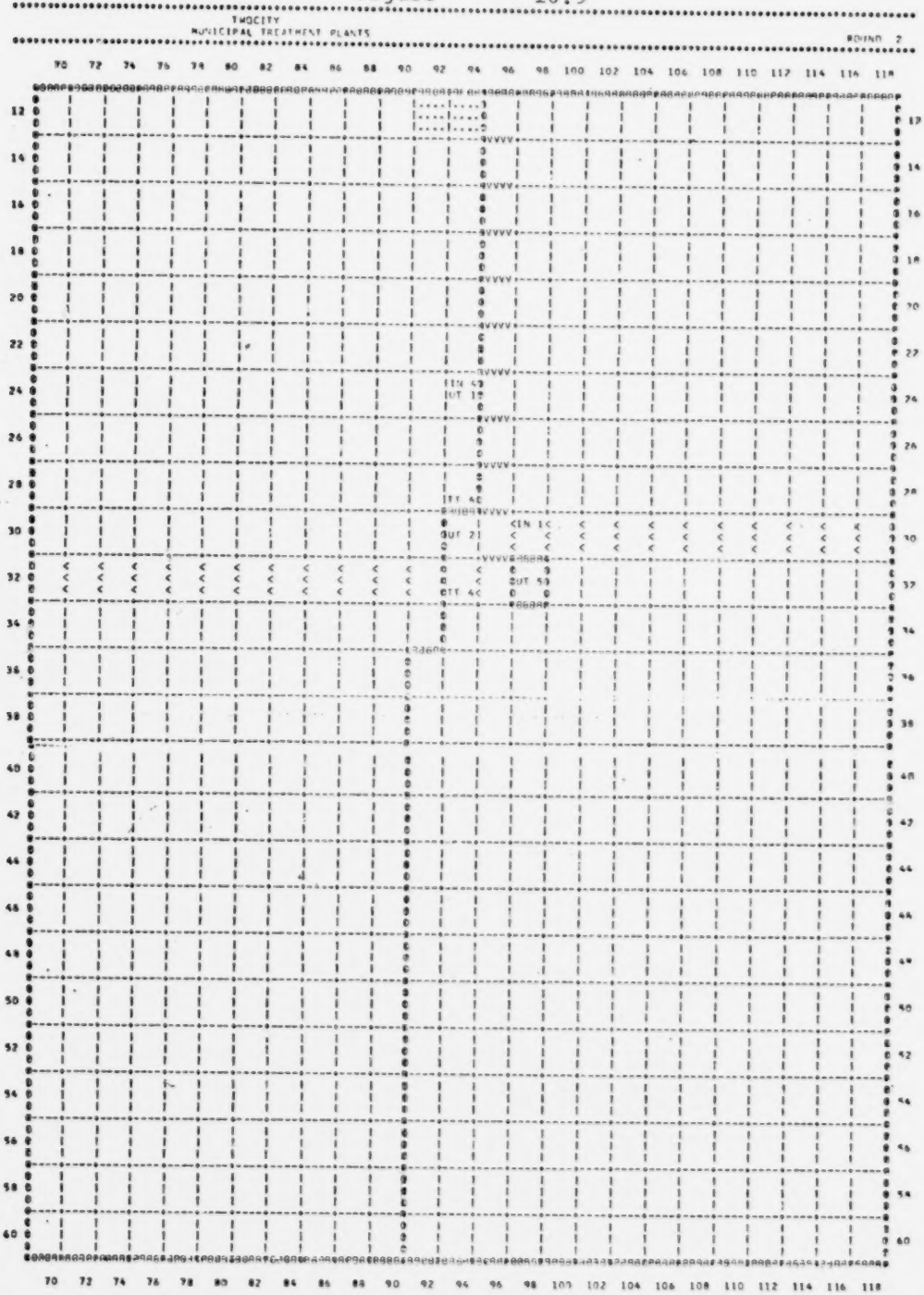
Municipal water intake and sewage treatment plants are located in the utility districts which they serve. An intake treatment plant processes the surface water removed from the parcel on which its intake point is located (not necessarily within the water district which it serves). All water treated by an intake treatment plant is processed to drinking water quality. The quality of the water before it is treated varies with the amount of pollution in the surface water where the intake point is located. There are nine water quality ratings, 1 being the best quality and 9 being the worst. A parcel's water quality rating is based on the volume of water on the parcel and the amount of pollution entering it from adjoining parcels.

Water Quality Rating	Description
1	Drinkable - best quality water
2	Drinkable - with minor treatment
3	Swimmable - direct body contact possible
4	Boating and Fishing - indirect body contact
5	Fair esthetic value
6	Poor esthetic value - treatable at moderate cost
7	No esthetic value - treatable at high cost
8	Negative esthetic value - treatable at very high cost
9	Unusable water

Seven types of pollutants are measured for the quality rating.

Pollutants	Description
BOD	Biochemical Oxygen Demand; the

Figure 10.9



PARCELS

TOP LEFT: IN FOR MUNICIPAL INTAKE
TREATMENT PLANT
TOP RIGHT: LEVEL OF INTAKE TREATMENT PLANT
MIDDLE LEFT: UT FOR UTILITY DISTRICT PLANT
MIDDLE RIGHT: CODE NUMBER OF UTILITY DISTRICT
BOTTOM ROW: MUNICIPAL EFFLUENT TREATMENT TYPE AND LEVEL

****
**** LAKE PARCELS
****

PARCEL EDGES

>>>< DIRECTION OF FLOW

---- NO WATER FLOWING BETWEEN PARCELS

0000 UTILITY DISTRICT BOUNDARY

Pollutants	Description
	natural breakdown of this pollutant causes a decrease in the concentration of dissolved oxygen in the water.
Chlorides	Chlorides are employed as an indicator of persistent pollutants.
Nutrients	Phosphate, nitrite, nitrate, nitrogen, and phosphorous.
Coliform Bacteria	Indication of the potential health hazard of a given body of water.
Temperature	A measure of the deviation from the normal temperature of the surface water.
Oil and Floating Solids	Any oil added to the system and all floating solids such as refuse, garbage, cans, boards, tires, etc.
High-Level Wastes	Highly toxic, non-degradable substances.

The quality of water at a district's intake point affects, among other things, the cost to process the water to drinking water quality. The water quality of a parcel is shown on the Water Quality Map. That quality is not affected by any pollution dumped on the parcel, only by pollution dumped on upstream parcels.

An inflow treatment plant, while able to make all but the worst (quality 9) water drinkable, has a capacity which is a function of its level. The amount of water which a district needs is a function of the needs of the activities located in the district, but the amount of water which a district can obtain may be limited by its inflow treatment plant capacity. Whenever a district cannot obtain all of its needed water for any reason, including insufficient inflow treatment plant capacity, the activities served by the district purchase that proportion of their water needs which cannot be met locally from the Outside at a high cost. The cost to

construct an inflow treatment plant increases with the number of levels constructed. Unlike levels of other activities in the model, municipal treatment plant costs and capacities are not necessarily even multiples of level one costs and capacities. The land requirements, however, are multiples of level one.

Municipal sewage treatment plants can be constructed not only to different levels (capacities) but also to different types of treatment. The types of sewage treatment are, in increasing order of pollution removal:

Chlorination (CL)
Primary Treatment (PT)
Secondary Treatment (ST)
Tertiary Treatment (TT)

Tertiary treatment requires the three other types of treatment; secondary treatment requires chlorination and primary treatment. The level of treatment printed on the map is the level of the type printed and of all lesser types. There is no provision for the case of different levels of different types of treatment within a single district.

Since treatment plants have fixed capacities which vary by their levels, any district's sewage in excess of its plant's capacity flows untreated into the surface water on the parcel on which the district's outflow point is located.

Note that all of a district's intake treatment must be located on a single parcel. Likewise, all of its sewage treatment must be on a single parcel, although that parcel does not have to be the same one as that on which its intake treatment plant is located.

'UT' appears in the middle row of a parcel if there is a utility plant on the parcel. Next to the 'UT' is the code number of the utility plant. That number matches the number printed next to the district's intake and outflow points on the Municipal Inflow and Outflow Point Map.

8. Water Quality Map

The surface water quality on a parcel is a function of the pollution entering the parcel from adjoining parcels and of the amount of water on the parcel itself. The water quality on a parcel is not affected by any dumping activity on the parcel itself. Any activity which removes water from a parcel removes it at the quality shown on the Water Quality Map.

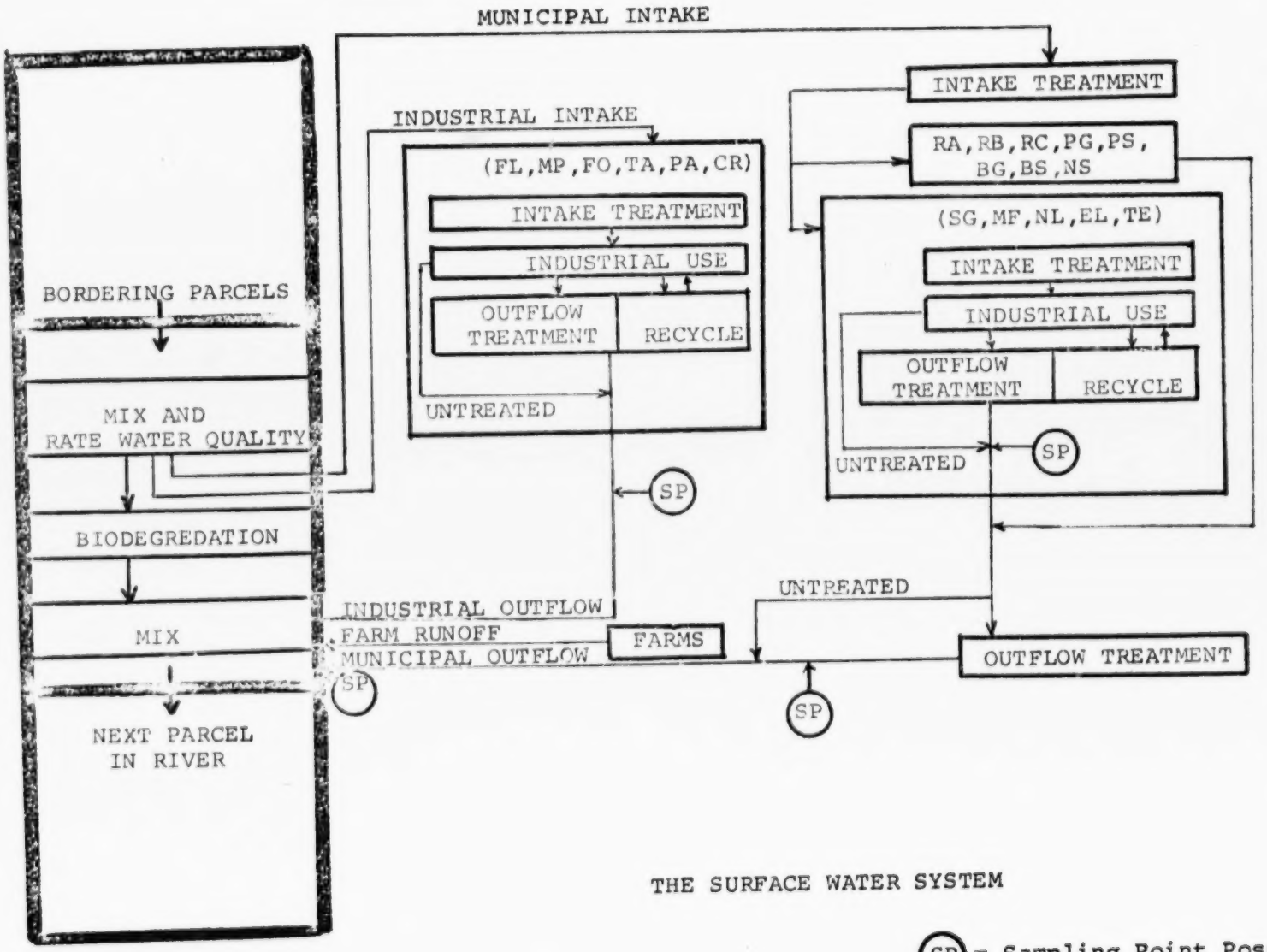
Quality is the only characteristic of surface water which can change during a run of the model. The other characteristics (rate of flow, volume, and surface area) are constant.

Water Sampling Stations can be set up to measure the exact pollution content of the water flowing out of parcels. Sampling stations can also be established to measure the pollution content of water generated by either individual economic activities or municipal systems. The operation of a sampling station is charged to the Utility Department of the jurisdiction in which the station is located.

The figure on the next page illustrates the processes which affect surface water pollution. The pollution flowing into a parcel from adjoining parcels is mixed in the water on the parcel. The pollution concentration per MGD is then measured and the water is rated in one of the nine water quality categories. The water quality rating is the worst rating category generated in any single pollutant. The rating allows no trade-off between a pollutant which is present in very low concentration and one which is very highly concentrated.

Next, water is removed if there are any intaking activities on the parcel. There are two types of intaking activities: 1) basic industries of the types which require surface water; and 2) municipal intake points. There can be only one economic activity on a parcel, and if it is a surface water user, it intakes and dumps on the parcel on which it is located. Municipal intake water is sent to the municipal intake treatment plant and from there to activities served by the district.

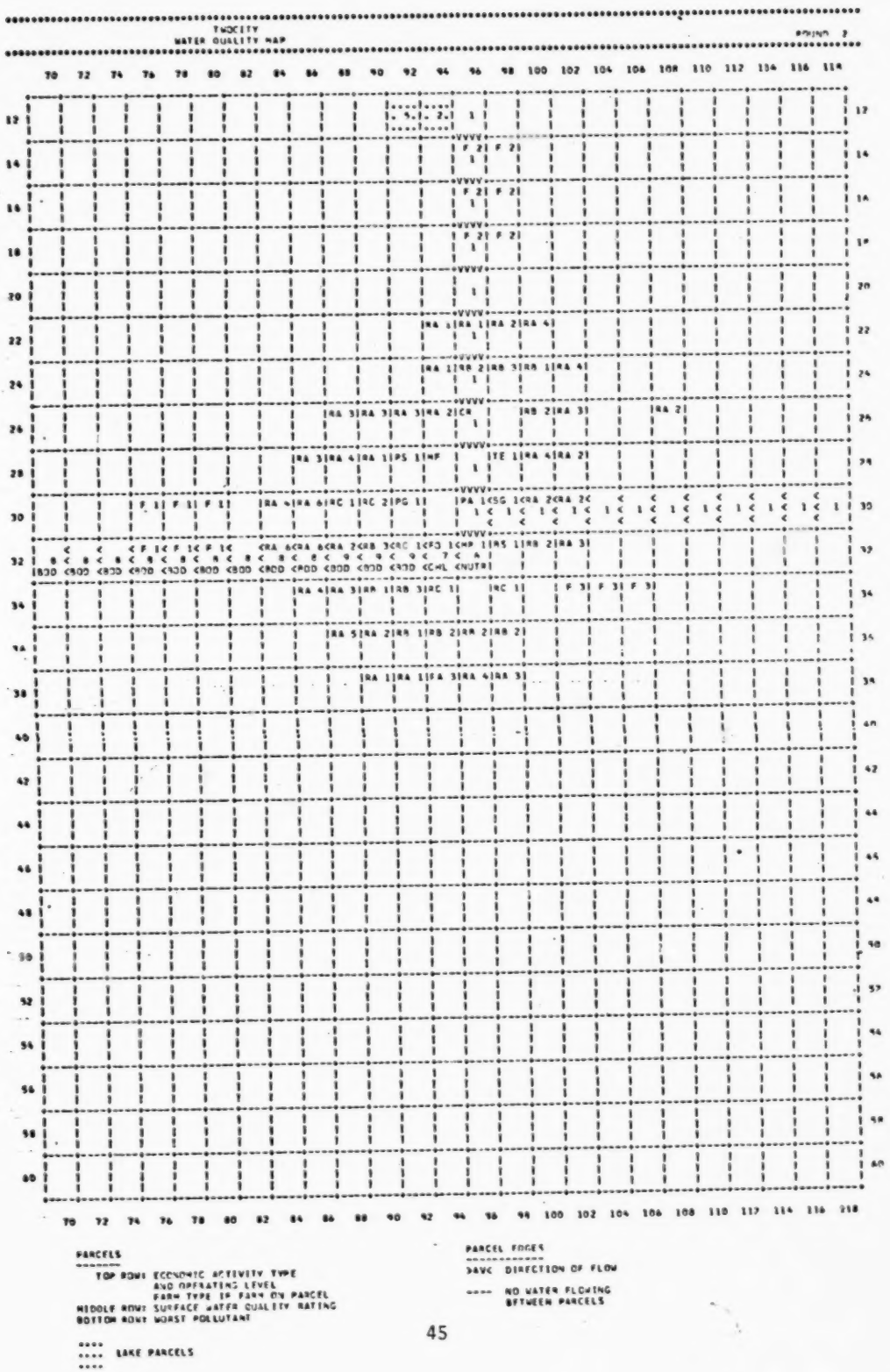
The surface water which is not removed undergoes a biological change process in which some of the pollutants decay naturally. That water is mixed with any water dumped on the parcel. There are three types of activities which can dump on a parcel. In addition to basic industries



THE SURFACE WATER SYSTEM

(SP) = Sampling Point Possible

Figure 10.8


TWOCITY
WATER QUALITY MAP
PARCEL EDGES
DIRECTION OF FLOW
NO WATER FLOWING BETWEEN PARCELS
PARCELS
TOP ROW: ECONOMIC ACTIVITY TYPE AND OPERATING LEVEL
FARM TYPE IF FARM ON PARCEL
MIDDLE ROW: SURFACE WATER QUALITY RATING
BOTTOM ROW: WORST POLLUTANT
LAKE PARCELS

and municipal outflow points, farm runoff can add to the pollution on a parcel. Whereas basic industries and municipalities can treat their effluent and thus remove some or all of their pollution, farm pollution can be cut back only if the farm owner decreases the amount of fertilizer used on the farm. The total amount of pollution is then moved on to the next parcel in the river.

The water quality map shows where rivers and economic activities are located in addition to water quality.

9. Water Usage Map

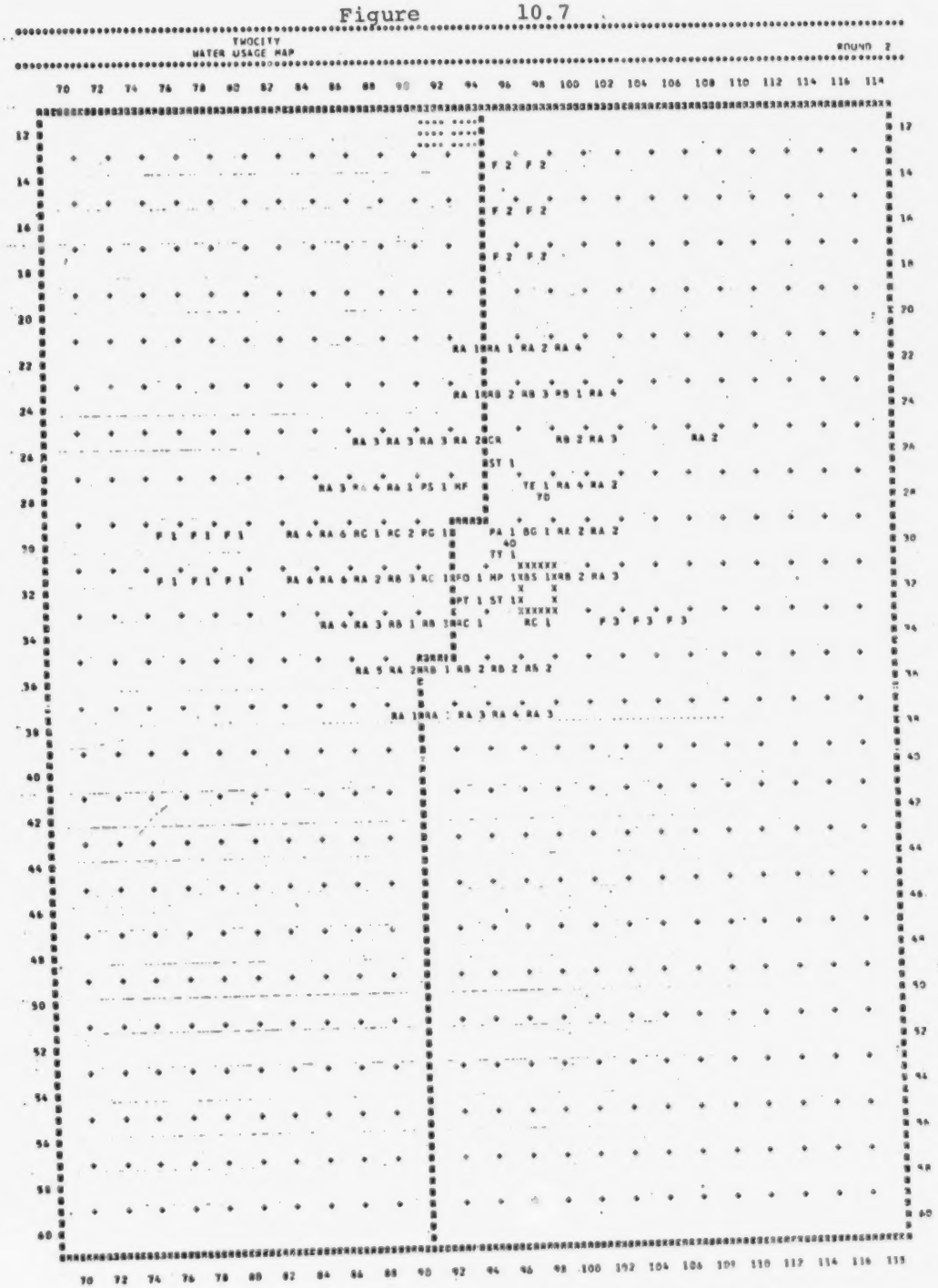
Basic industries can treat their effluent in order to remove pollutants. An industry's effluent treatment plant is located on the same parcel as the industry and does not consume land. Like municipal effluent treatment plants, industrial treatment plants can be of four types: chlorination (CL), primary treatment (PT), secondary treatment (ST), and tertiary treatment (TT). Industrial treatment plants can be constructed to any level and each treatment plant level has the capacity to treat all of the effluent of a level of the industry type which it is constructed to serve. The construction cost of a level of treatment plant varies by treatment type and type of industry.

Industries can recycle up to half of their effluent. Recycled water is not processed through an effluent treatment plant. Its treatment is a process distinct from industrial intake or outflow treatment and costs a fixed number of dollars per MG recycled. So, a level two industry at a recycle level of 100% and having a level one effluent treatment plant treats all of the water which it dumps. If the recycle level under those conditions were 50%, then the industry would treat only two-thirds of the amount which it dumped and one third would be dumped untreated.

Unlike municipal water intake treatment facilities, industrial intake treatment is assumed to exist when the industry is constructed and it is assumed to have the capacity to treat all of the water required by the industry. Like municipal intake treatment costs, industrial intake treatment costs increase as water quality worsens, and the worst water (quality 9) cannot be treated. The industry is forced to pay a high cost for water, the cost represented by the Outside price of water. Furthermore, intake water quality affects the depreciation of surface water users, a reflection of wear on treatment equipment.

NOTE: Regardless of the amount of recycling, intake water quality has the same effect on industrial depreciation. The volume treated does not matter. The assumption is that recycled water goes through intake treatment, so no wear and tear on treatment equipment has been avoided.

Figure 10.7

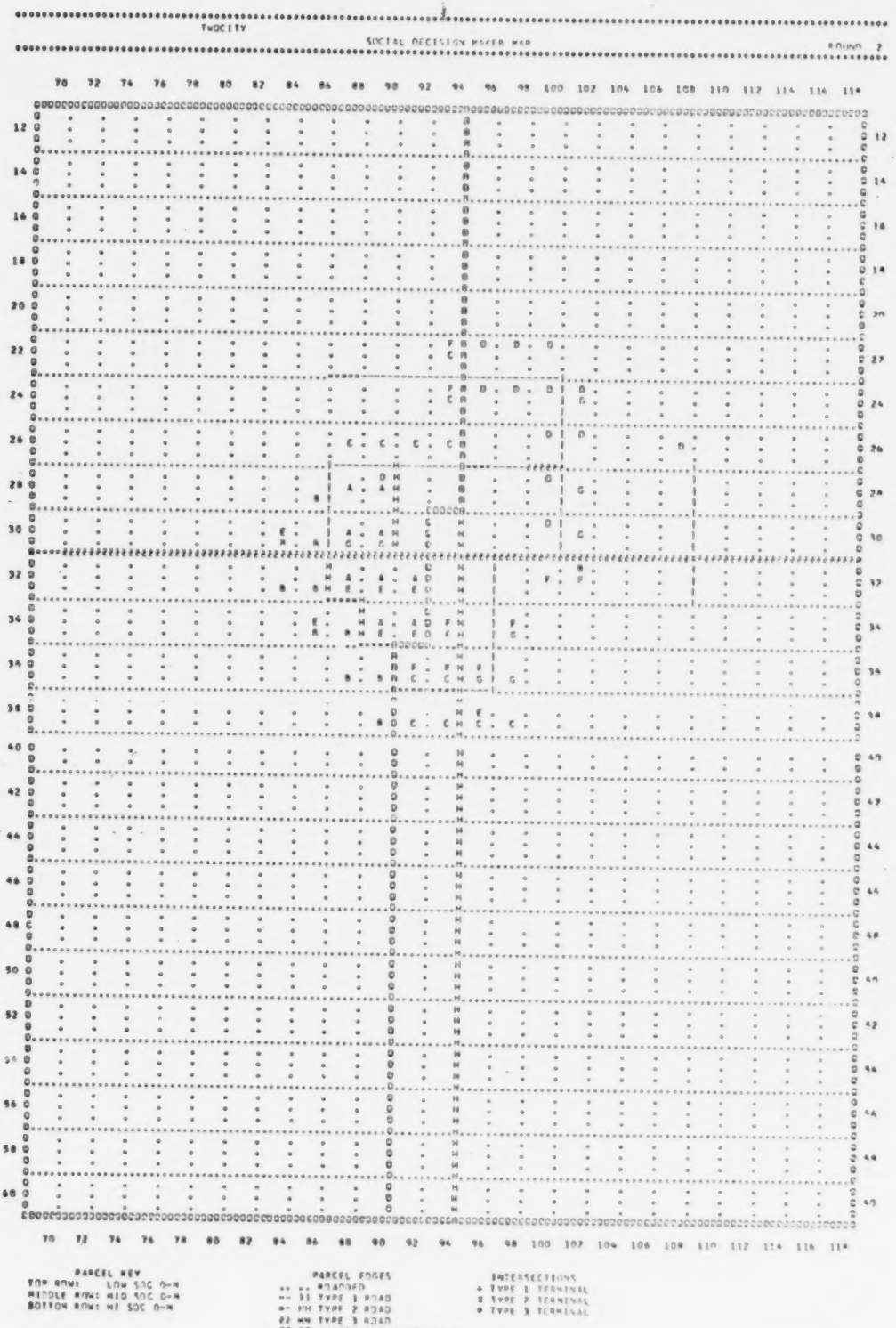

TWOCITY
WATER USAGE MAP
ROUND 2
PARCELS
TOP ROW: ECONOMIC ACTIVITY TYPE AND OPERATING LEVEL
MIDDLE ROW: (FOR BASIC INDUSTRIES) PERCENT OF WATER RECYCLED
BOTTOM ROW: (FOR BASIC INDUSTRIES) EFFLUENT TREATMENT TYPE AND LEVEL
PARCEL EDGES
XX XX UTILITY DISTRICT BOUNDARY
OO OO JURISDICTION BOUNDARY
BB BB BOTH
LAKE PARCELS

10. Social Decision Maker Map

This map indicates which social players make decisions for the low, middle, and high income population units on parcels. The top letter on a given parcel represents the social decision-maker who controls the PL's who live there, and the middle and lower letters represent the social decision-makers who control the PM's and PH's, respectively, who live there. If a particular class does not live on a parcel, no letter is printed.

Not until a parcel is developed for residential land use and occupied by at least one income class, will a social decision-maker for that parcel appear on the map. Note that different decision-makers may control the different population classes on a single parcel. Social teams acquire control over additional Pl's on a parcel when the number of Pl's of that class moving into the parcel exceeds the number moving out. Social teams may find that from round to round they gain or lose control of population units on a residential parcel of land. This occurs as a result of the migration of Pl's of a class to a parcel where previously there were no Pl's of that class (a gain) or as a result of the migration away from a parcel of all the Pl's of a class on that parcel.

Figure 10.24


TWOCITY
SOCIAL DECISION MAKER MAP
ROUND 2
PARCEL KEY
PARCEL EDGES
INTERSECTIONS

C. Summary Information

1. Demographic and Economic Statistics

The output summarizes a wide variety of information about the simulated region. There are two basic types of information: statistics by jurisdiction and for the region as a whole about local conditions, and measures of interactions between the region and the Outside System. The former provide comparisons between jurisdictions; the latter provide comparisons between the local and Outside systems.

Statistics Regarding Local Conditions

Total population: the number of people (not Pl's), by class.

Percent change over previous year: the total population change, positive or negative, between the current round and the previous round. This is the only local statistic which is given only as a total and not broken down by jurisdiction.

Average population per parcel: the number of people divided by the number of parcels.

Developed land (in parcels): the amount of land area (in parcel equivalents) consumed by public and private developments.

Undeveloped land: the amount of land area (in parcel equivalents) not consumed by developments.

Total land area: the number of parcels.

Assessed value of land in millions: the property tax base.

Assessed value of developments in millions: the development tax base.

Average quality of life index: a measure across classes of the people's average quality of life index. The higher the index, the poorer the quality of life. The indexes may differ significantly within a jurisdiction, but only averages are given here.

Number of registered voters: the number of people eligible to vote, from which the number who actually vote are selected.

TWOCITY

DEMOGRAPHIC AND ECONOMIC STATISTICS ROUND 1

	TOTAL	JURISDICTION I	JURISDICTION II	JURISDICTION III
TOTAL POPULATION	275500	126000	149500	0
LOW CLASS	73500	0	73500	0
MIDDLE CLASS	99000	64000	35000	0
HIGH CLASS	103000	62000	41000	0
PERCENT CHANGE OVER PREVIOUS YEAR	0			
AVERAGE POPULATION PER PARCEL	0	0	0	0
DEVELOPED LAND (IN PARCELS)	77	30	46	0
UNDEVELOPED LAND	548	266	283	0
TOTAL LAND AREA	625	296	329	0
ASSESSED VALUE OF LAND IN MILLIONS	12312.	5321.	6992.	0.
ASSESSED VALUE OF DEVELOPMENTS IN MILLIONS	421.	158.	264.	0.
AVERAGE QUALITY OF LIFE INDEX	69	61	75	0
NUMBER OF REGISTERED VOTERS	88573	45566	43007	0
NO. IN PUBLIC ADULT EDUCATION	0	0	0	0
AVERAGE EDUCATIONAL LEVEL	59	73	47	0
LOW	17	0	17	0
MIDDLE	61	61	62	0
HIGH	5232824	4061270	278305	0
NO. OF WORKERS RECEIVING WELFARE	12800	0	12800	0
STUDENT/TEACHER RATIO	7	13	10	0
SCHOOL ENROLLMENT				
PUBLIC	48740	34040	14700	0
PRIVATE	20460	0	20460	0
HOUSING UNITS				
SINGLE DWELLINGS	100	62	38	0
MULTIPLE DWELLINGS	24	7	17	0
HIGH RISE APARTMENTS	6	4	2	0
VACANCY RATE (PERCENT)	4	28	-23	0
NEGATIVE MEANS OVERCROWDED				

Figure - 9.1 (Cont'd)

NUMBER OF EMPLOYED WORKERS	79400	35360	44040	0
LOW	23000	0	23000	0
MIDDLE	31680	20480	11200	0
HIGH	24720	14880	9840	0
NUMBER EMPLOYED IN				
LIGHT INDUSTRY	27160	10240	16920	0
HEAVY INDUSTRY	27760	11800	15960	0
NATIONAL SERVICES	0	0	0	0
CONSTRUCTION INDUSTRY	0	0	0	0
BUSINESS GOODS	2800	1680	1120	0
BUSINESS SERVICES	5240	0	5240	0
PERSONAL GOODS	3360	3360	0	0
PERSONAL SERVICES	5680	2480	3200	0
MUNICIPAL SERVICES	1920	1920	0	0
SCHOOLS	3880	3880	0	0
RAIL	0	0	0	0
BUS	0	0	0	0
FEDERAL-STATE	1600	0	1600	0
NUMBER OF UNEMPLOYED WORKERS	6400	0	6400	0
LOW	6400	0	6400	0
MIDDLE	0	0	0	0
HIGH	0	0	0	0
UNEMPLOYMENT RATE (PERCENT)	7.46	0.0	12.69	0.0
LOW	21.77	0.0	21.77	0.0
MIDDLE	0.0	0.0	0.0	0.0
HIGH	0.0	0.0	0.0	0.0
PERCENT EARNING UNDER $ 5,000	33	5	55	0
PERCENT EARNING $5,000 TO $10,000	37	54	22	0
PERCENT EARNING OVER $10,000	29	39	21	0

Number in public adult education: the number of people who wanted to participate in public adult education programs and were able to do so because programs were provided by their school departments.

Average educational level: by class, the average educational level. This ranges from 0 to 100. The higher a worker's educational level relative to those of other workers, the greater his chances of being hired before the others.

Number of workers receiving welfare: if a jurisdiction does have a program for aid to the unemployed, this number is the number of unemployed workers. The number is zero if there are either no unemployed workers or no welfare program.

Student/teacher ratio: ratio of number of students attending local public schools to number of teachers employed by public schools. This is a factor when students are allocated to public or private schools.

School enrollment: the number of students attending local public schools and the number attending private schools. Students attend private schools only if the public schools in their districts are inadequate.

Housing units: the number of levels of RA (single family), RB (town house, multiple dwellings), and RC (high rise) housing.

Vacancy rate: the ratio of existing housing space to housing space occupied, expressed as a percent. A negative rate means that housing is overcrowded.

Number of employed workers: the number of people holding full-time jobs, by class of worker.

Number employed by type of employer: the number of full-time workers employed by each type of business and government employer.

Number of unemployed workers: by class, the number of workers seeking full-time employment who were unable to obtain jobs.

Unemployment rate (percent): by class, the number of unemployed workers as a percent of the total number of workers who sought full-time jobs.

Earning distribution: the percent of workers earning less than $5,000, between $5,000 and $10,000, and over $10,000 from full-time employment.

Transactions With the National Economy

Income from the national economy: federal-state aid received, by type of aid, and income from both basic industry sales of output and bus and rail sales of equipment.

Sales to the national economy: federal-state taxes paid, by type of tax, and purchases of goods, services, and outside-owned land. The only Outside expenditure which can be significantly controlled locally is the purchase of goods and services due to local insufficiency.

National economy business cycle: last round's ratio to "typical income"per unit of output for basic industry, interest rates on loans and bonds from the Outside (expressed as percents), and the average rate of return on outside investments (expressed as percents).

2. Summary Information for the Social Sector

Social Control Summary

This table shows, by class and jurisdiction, the number of population units controlled by each social decision-maker. A social decision-maker begins a game controlling a certain number of P1's in each class in each jurisdiction (that number may be zero). The number of P1's which the decision-maker controls in subsequent rounds is determined by the migration process, which moves P1's into, out of, and within the simulated region in response to both local and exogenous influences. The migration process allocates people to housing; it does not determine which social decision-makers control those people. Before the start of a game, each parcel in the simulated region is assigned a decision-maker for each of the three social classes. When a class occupies a parcel, it comes under the control of the decision-maker originally assigned to that class on that parcel. The Social Decision-Maker Map shows which teams control classes already living on residence parcels. When a new class occupies a parcel, its decision-maker appears on the map.

Social Control Summary (one table for each social decision-maker)

Figure 7.5

TWOCITY
SOCIAL CONTROL SUMMARY TOTALS ROUND 2

	JURISDICTION 1			JURISDICTION 2		
TEAM	PH	PM	PL	PH	PM	PL
AA	0	94	0	0	0	0
BB	43	0	0	0	0	3
CC	0	20	0	25	0	0
DD	0	0	1	0	3	153
EE	48	2	0	14	1	0
FF	0	0	2	0	67	0
GG	36	0	0	42	10	0

Figure 7.4

TWOCITY
SOCIAL CONTROL SUMMARY TEAM AA ROUND 2

LOCATION	CLASS	FAMILY INCOME (PER WORKER)	FAMILY SAVINGS	TOTAL DISSATISFACTION
8828	MIDDLE	5071	-495	353
9028	MIDDLE	2500	-2006	292
8830	MIDDLE	6180	503	353
9030	MIDDLE	4753	70	327
8832	MIDDLE	2800	-2137	441
9032	MIDDLE	4798	122	415
9232	MIDDLE	3625	-1235	457
9034	MIDDLE	4458	2228	367
9234	MIDDLE	2662	-764	355

This table contains one row for each class on each parcel controlled by the social decision-maker. The first two columns show the residence parcel coordinates and the class. Next is the average income for a household (family) of that class living on that parcel. A household consists of one full-time worker. The number of workers in a Pl of each class and the typical full-time salary earned by a worker in the class are shown on the Master Tables. In almost all of the model's processes, all Pl's in the same class living on the same parcel are treated alike, so the average for a parcel is in effect the actual for a Pl.

The fourth column contains the average savings per family for the year. The figure is annual income less annual expenditures, and does not include any savings or dissavings from previous years.

The final column, total dissatisfaction, is the total of all of the indexes measuring the effect of local conditions on the population on the parcel. The higher the dissatisfaction, the worse the conditions. The dissatisfaction index is the quality of life index, which is a factor in the migration process.

Social Control Summary (two graphs for each social decision-maker)

The two graphs printed for each social decision-maker show an historical comparison of two types of information shown on the previously-described table: net income and quality of life index. Whereas on the tables information is given for each class on each parcel which the decision-maker controls, the information on the graphs is the average of all of the Pl's in the same class controlled by the decision-maker. The graphs show the relative values of those items for the most recent ten years. Each year has three columns on the graph, one for low-income (L), one for middle-income (M), and one for high-income (H). Round 1 is Year 5 on the graph, Round 2 is Year 6, and so on. After 6 rounds have been played (years 5 through 10 on the graph), the data for the earliest year are erased and only data for the most current 10 years are shown. Year 10 is always the most recent round.

On the net income graph, the net income for each class for each year is shown as a ratio to that class's net income during the first year. The first year is always 1.00. Thus, although high-income Pl's usually have a higher net income than middle-income Pl's, their incomes

Figure 7.7a

Social Graphs for Teams: Relative Per Capita Income by Class

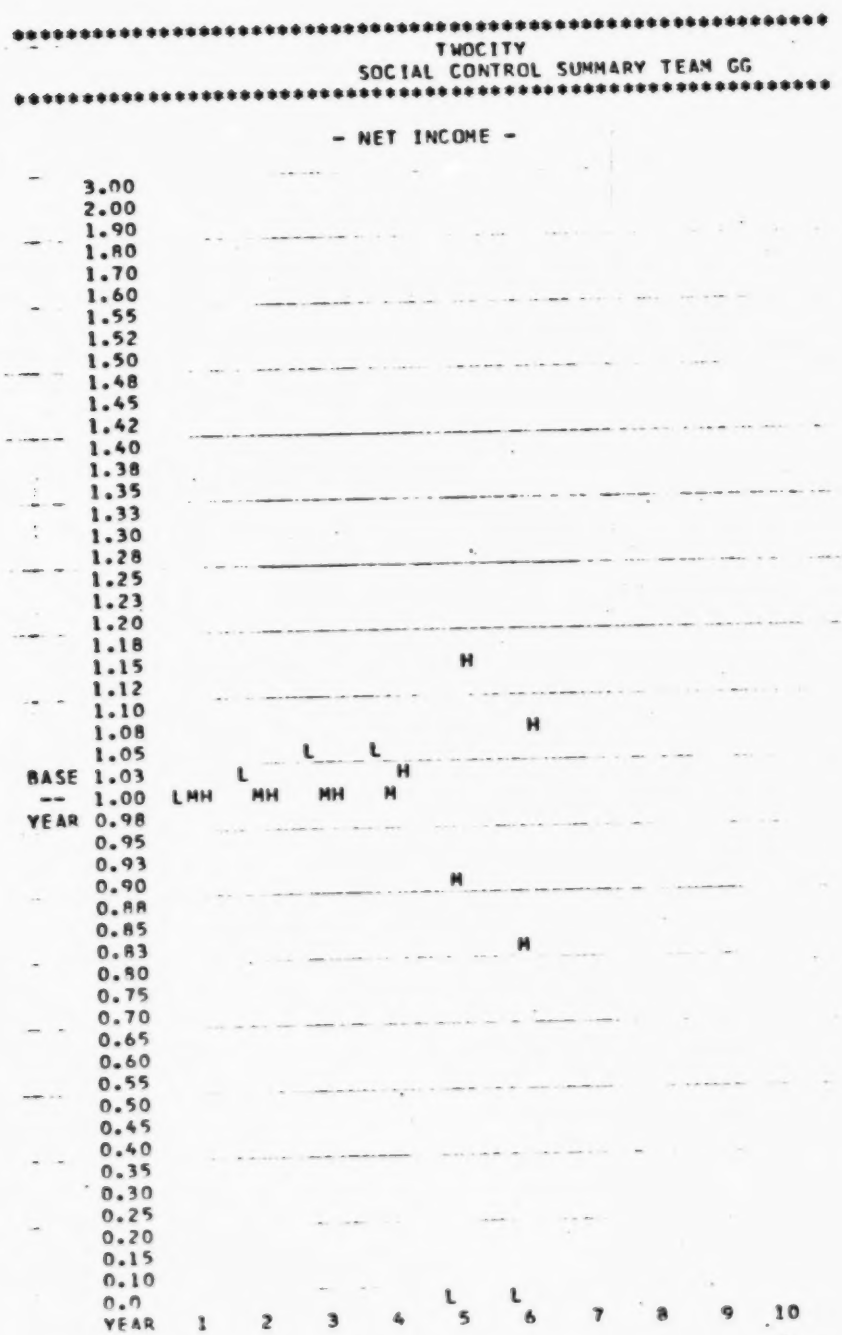
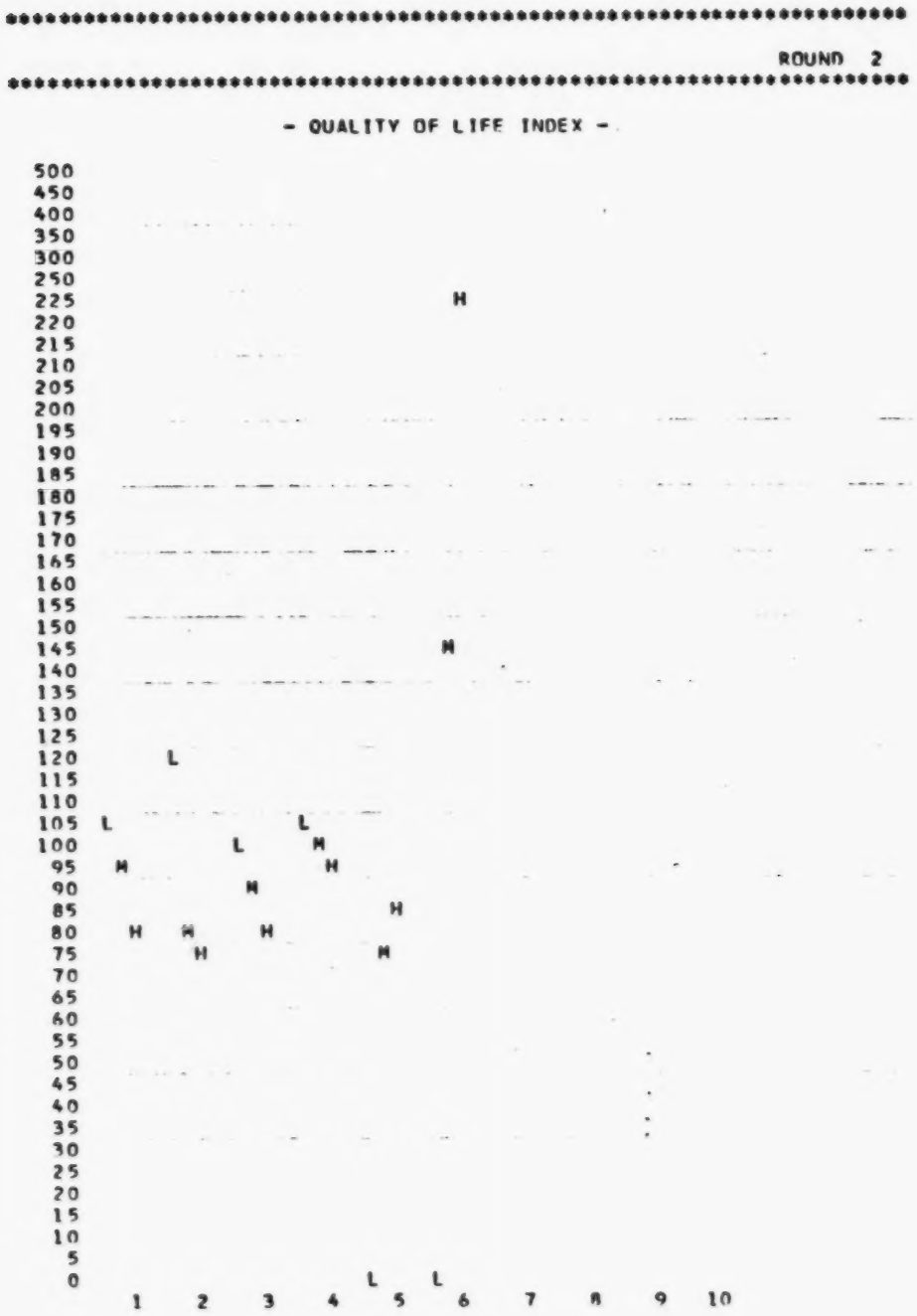


Figure 7.7b

Social Graph for Teams: Quality of Life Index by Class



relative to previous years can be easily compared even across classes.

If a decision-maker does not control any Pl's in a particular class during a year, that class's letter prints on the bottom row of the graph.

The quality of life index graph shows each class's average quality of life index as an absolute value, not relative to a base year. Each class measures the factors in the quality of life index differently, so there can be little comparison between classes on this graph. The main comparison is within a class between years.

D. SOCIAL SECTOR DETAILED OUTPUT

1. Dollar Value of Time

The social sector has four types of resources: time, voting power, money, and the power to boycott. The first two are unique to this sector, but it is through time allocation that social decision-makers can increase their voting strength. Time can be allocated to extra work, adult education, politics and recreation. Time is not specifically allocated to transportation to full-time work, but transportation makes the first claim on allocatible time; it decreases time available before time allocated to any other activities is considered by the program. The more time which a P1 spends travelling to work, the less time it has to spend in other more personally useful activities. A decision maker or the director can affect the amount of time which P1's spend travelling through the decision to specify the dollar value of a time unit travelling.

The computer assigns all population units to modes of transportation to and from work on the basis of least cost. Least cost includes transportation charges (which differ according to mode of transportation, type of road and amount of congestion) as well as the dollar value of time spent traveling. The social decision-maker or director is able to specify the dollar value of one time unit consumed traveling to and from work for each of the classes. As the dollar value of a time unit spent traveling increases, there is a greater chance that the computer will assign a more expensive but quicker mode of transportation to work (i.e., via automobile or rapid rail rather than bus). The following example will demonstrate how the computer considers the dollar value of time.

Assume that the tranpsortation dollar costs for one worker is $150 per year to get to work by bus and $230 to get to work by auto. It also requires an extra 4 time units to travel by bus instead of auto.

If the dollar value of time for that population unit was set at $40 then $160 (4 x $40) would be added to the bus cost to arrive at a total cost of $310 to get to work by bus. To take an auto it costs $320 (no extra time units consumed). Therefore, the computer would assign the population unit the BUS mode to travel to work (since $310 is less than $320).

In the same case, suppose the dollar value of time was set to $50. Then the total bus cost would be $150 plus 4 time units times $50 (dollar value) or $350. Auto

Figure - 5.1

TWOCITY
DOLLAR VALUE OF TIME — JURISDICTION 1 — ROUND 2

	SOCIO-ECONOMIC CLASS		
TEAM	HIGH	MIDDLE	LOW
AA	20	15	10
BB	10	8	6
CC	47	44	38
DD	54	41	37
EE	52	49	36
FF	59	32	8
GG	57	43	34

would cost only $320. Therefore, the computer would assign these population units the auto mode to work (since $320 is less than $350).

A worker pays only the actual dollar cost to get to work. The dollar value of time is used for route and mode allocation purposes only. The dollar value of time represents the worth of a time unit being spent in transportation relative to the time unit being spent in other activities.

2. Social Decision-Maker Detailed Output

This output shows the characteristics and financial status of the Pl's controlled by a social decision-maker in each jurisdiction, in each class on each parcel. The characteristics and financial status of the Pl's in the same class on the same parcel are averages. They can differ only in their employment locations and salaries earned. For all other purposes, the model uses averages for the whole group.

The output contains one column for each parcel.

a. Location and Number of Pl's

The first two rows identify the residence location and number of Pl's in the class living there.

b. Education Level

A Pl's educational level affects its chances of obtaining a job. The higher its educational level relative to educational levels of others seeking employment, the greater its chances of getting a higher paying job. A social decision-maker can increase his Pl's educational levels by allocating time to adult education. Adult education represents an investment of time and money resources to improve a worker's relative usefulness to an employer, whether the investment be in courses, reading, or skill and experience improvement.

Public (free) adult education can be provided only by a jurisdiction's School Department. If the School Department of the jurisdiction in which a Pl resides does not provide an adult education program, the Pl cannot obtain free adult education. If the department does not provide enough adult education for the requests of the people in the jurisdiction, then all of the Pl's have only a portion of their requests satisfied. Pl's can also allocate time to private adult education, which they are assured of obtaining (if they have enough time units remaining after other time allocations) but which is relatively expensive.

c. Voter Registration Per Pl

Voter registration represents the maximum number of votes per Pl which the decision-maker can cast in an election. If voting is done through the computer, a portion of the registered voters turn out for an election.

Figure -5.2

TWOCITY
SOCIAL DECISION MAKER GG HIGH SOCIO-ECONOMIC CLASS

LOCATION	8830	9030
NUMBER OF P1'S	13	23
EDUCATION LEVEL	90	81
VOTER REGISTRATION PER P1	216	216
PREVIOUS SAVINGS PER P1	256269	130233
PERCENT OF P1'S UNEMPLOYED	0	4
INCOME PER P1		
EMPLOYMENT(FULL)	1312615	1292727
EMPLOYMENT(PART)	160384	0
WELFARE	0	204000
MISCELLANEOUS	538	0
EXPENDITURES PER P1		
RENT	322000	276000
TRANSPORTATION		
AUTO	61551	72980
BUS	0	0
RAIL	0	0
GOODS	370000	370000
SERVICES	155200	155200
SCHOOL (CHILDREN)	39000	39000
SCHOOL (ADULTS)	0	0
HEALTH	8000	8000
SALES TAX	22894	22894
INCOME TAX	232500	195756
AUTOMOBILE TAXES	908	1406
MISCELLANEOUS	0	0
SAVINGS PER P1	260946	355491
NEW BALANCE PER P1	517215	485724
TIME ALLOCATION PER P1		
TRANSPORTATION	5	15
ILLNESS	3	3
EXTRA JOB (25)	10	0
EDUCATION		
PUBLIC (0)	0	0
PRIVATE (0)	0	0
POLITICS (35)	35	35
RECREATION (10)	10	10
INVOLUNTARY	37	37
HEALTH INDEX	25	25
PERSONAL INDEX	67	116
NEIGHBORHOOD INDEX	163	162
ENVIRONMENTAL INDEX	246	245
QUALITY OF LIFE INDEX	313	361

The decision-maker can increase the fixed minimum number of voters in a P1 by allocating time to political activity. The increase lasts for one round only, so a high registration can be maintained only if time is allocated to politics each round.

d. Previous Savings Per P1

This is the average savings or deficit which a P1 has from previous years. It is added to the new savings (the current round's income less expenditures) and becomes the new balance, next round's previous savings.

e. Percent of P1's Unemployed

This is the number of P1's who were unable to obtain full-time jobs expressed as a percent of the number of P1's of the class living on the parcel.

f. Average Income Per P1

The population living on a parcel can derive income from up to four sources: full-time employment, part-time employment, welfare, and miscellaneous (cash transfers from other social or economic decision-makers or government departments). Welfare can be received only by those P1's who are unemployed and is paid by the jurisdiction in which they reside, if that jurisdiction has a welfare program.

g. Average Expenditures Per P1

Most personal expenditures are only partially affected, if at all, by social decision-makers. A level of each residence type has a fixed number of space units. A P1 of each class occupies a fixed number of space units. A residence owner sets a rent per space unit and a P1 pays rent on the number of space units which a P1 of its class occupies. Although the rent charged at a residence is set by its economic sector owner and the residents must pay that amount, rent is a factor in the allocation of people to housing in the migration process.

Transportation expenditures are incurred in the trip to work and to obtain goods and services. Auto, bus and rail may be used in the trip to work, but only auto may be used in commercial trips. All transportation routes and costs are calculated by the computer program. See the Employment Detail and Commercial Detail descriptions for more information on transportation costs.

The Commercial Detail description also explains Pl expenditures for goods and services, part of which is affected by the amount of time which a Pl spends in recreation.

A Pl pays for private education for its children if local schools are inadequate. Students are assigned to schools by the computer. Middle and high income families have certain criteria for the school in their district. If the school fails to meet these criteria, these students will be assigned by the computer to private schools at the expense of the population unit they represent. Those criteria are shown on the Master Tables. Students of the low socio-economic class go to the public school in their district regardless of the high and middle class criteria, unless their residence location is excluded from a district. The cost for private school varies by class and is shown on the Master Tables. A Pl pays for adult education if it has allocated time to private education. There is a fixed cost per time unit spent in adult education.

A Pl has a fixed annual health expenditure which varies with the Pl's class. In addition to that base amount, a Pl on a parcel having surface water or adjoining a parcel having surface water incurs a greater expenditure if there are any coliform bacteria in the water See the Master Tables for the precise costs.

There are three types of taxes which a Pl may have to pay: sales taxes, income taxes, and automobile taxes. There is a fixed state sales tax rate on all purchases of personal goods and services, regardless of whether the goods or services are purchased from local establishments or from the Outside. Local governments may also set tax rates on PG and PS purchases from commercial establishments within their own jurisdictions. That tax revenue accrues to the government of the seller's jurisdiction.

There are fixed federal-state income tax rates on all Pl's total full-time and part-time gross income. Local governments may also tax the gross income of the Pl's living in their jurisdictions and/or working in their jurisdictions. The tax revenue goes to the account of the jurisdiction levying the tax.

There are no fixed automobile taxes. Local governments may tax total automobile expenditures to get to full-time and part-time work by PL's living in their jurisdictions and/or working in their jurisdictions.

Miscellaneous expenditures are cash transfers made by the social decision-maker to other social or economic decision-makers or government departments.

h. Time Allocation

As mentioned above, social decision-makers allocate time for their P1's to spend in extra work, adult education, politics and recreation. There are 100 units of leisure time available to each P1. Two types of time allocation are not set by a decision-maker: time in illness and time in transportation. The time units spent in those two categories are first deducted from a P1's 100 available time units before any time is spent in other activities.

Transportation time is explained above. The number of time units which a P1 spends in illness is equal to one-tenth of the health index on its residence parcel. The health index is a function of the use index of the municipal services unit serving the parcel, the amount of overcrowding at the residence, and the amount of coliform bacteria in the surface water on the parcel or on adjoining parcels.

The computer program performs all of the actual time allocation process in response to decision-makers' time allocation requests. If, after time has been subtracted for illness and transportation, the P1 has any remaining time units, it may enter the part-time employment process. The amount of time spent in part-time work is subtracted from the remaining time units, and if any time units remain, the P1 may enter the adult education allocation process. Politics and recreation are processed last, in that order, and in the same fashion with regard to not exceeding the 100 allocatable time units.

All of the time which a P1 allocated to a specific activity but was unable to spend in that activity contributes to "involuntary time". If during the time allocation process a P1 uses up all of its 100 time units, no time may be spent in subsequent activities.

All of the allocated units in excess of 100 become involuntary time. There are two other sources of involuntary time. If a P1 cannot obtain all of the part-time work which it requests (due to there being a greater number of time units allocated to part-time work than there are part-time jobs) the portion of the allocated time which was unfilled adds to involuntary time. The other source of involuntary time is the portion of a public adult education request which cannot be met by local adult education programs.

Involuntary time and transportation time contributes to a P1's personal index. Recreation time decreases the personal index.

A social decision-maker sets the dollar value of a time unit travelling for all of a class boardwide. The dollar value of time of the high-income people controlled by BB, for example, cannot be different for those PH controlled by BB in jurisdiction 1 than it is for BB's PH in jurisdiction 3. Social decision-makers can, however, allocate time by jurisdiction and even by parcel. A decision-maker's preferred time allocations appear in parentheses to the right of the row headings labelling the types of allocations. Any exceptions for the decision-maker's preference on individual parcels show the preferred allocations in parentheses next to the actual allocations for the parcel.

i. Indexes

The Social Detailed Output also lists the values of five indexes used in the migration process. See the description of Migration for details.

3. Social Decision-Maker Boycott Status Output

Social decision-makers can boycott working for specific employers, shopping at specific PG or PS establishments, or using either the bus or rail modes of transportation. A boycott is in effect for an entire round and is continued until a decision is submitted to stop the boycott. The boycott output has one row per boycott, showing the social decision-maker boycotting, the class boycotting, the function boycotted (work, shop, or use), the location boycotted (0 if the boycott is against working for a government department), the land use boycotted (0 if the boycott is against a government department), and the owner of the establishment being boycotted (department and jurisdiction if the boycott is against a government department).

Figure 5.3

```
**********************************************************************
     TWOCITY
  SOCIAL DECISION MAKER GG    BOYCOTT STATUS OUTPUT              ROUND  2
**********************************************************************
```

	BOYCOTTING		BOYCOTTED		
TEAM	CLASS OR LAND USE	FUNCTION	LOCATION	LAND USE	OWNER
GG	HIGH	WORK			SC1

IV. Social Sector Decisions

A. Summary of Decisions

The three socio-economic classes all have the ability to make the same type of decisions in the model although the relative effect of these might be different. Further, most of the power in this sector will be manifest only if teams are able to join with one another in some form of organization. For example, a strike by the population units under Team AA's control may not be effective at all if the other teams allow their population units to work for the employer. In fact, if the latter happens likely the only one disadvantaged would be the population units of Team AA. This factor helps to explain the rise of unions. The same general principle applies to voting and the development of political power.

There are four basic types of decisions available to this sector to effect desired outcomes. These are voting, boycotting, allocating (or budgeting) time, and transferring cash.

1. Voting

In our society, people are able to exercise power over those who govern them by periodic elections. Further, there are continuing polls being taken which indicate in some ways the quality of the job being done by the elected officials. Also, in many local governments the populace is given the opportunity to vote in referenda to determine the desirability and acceptability of certain expenditures.

The Social Decision-Maker is able to exercise all of these options in this model. The Chairman and the Council are elected officials. Further, it is possible to vote each round, or at regular intervals even in off-election years to indicate agreement or disagreement with current government policies and to vote on specific referenda.

The number of votes which can be cast is determined by the number of registered voters controlled by each decision-maker.

In terms of determining the course of action in the area, voting is an important instrument. Politicians, if they expect to be elected, must have the support of a number of social decision-makers representing at least a popular majority. Support can be gained in a number of ways. Candidates can be bound to certain principles and programs before a social decision-maker will throw his votes behind a candidate, or campaign promises can be made. The voting system represents the political process in the model with all the possible coalitions, factions, and political tradeoffs also found in the real world.

2. Boycotting

A powerful negative sanction available to the social decision-maker is the ability to withhold the labor or purchasing power of the people he controls. In addition to the work or transit strike, it is possible to stop shopping at particular establishments. The computer assigns people to shop at particular goods and services establishments and work at specific jobs; decisions to boycott particular establishments causes the computer program to ignore those places as options for the boycotting population units. It will continue to do so until told to stop by a decision input to stop the boycott.

The computer usually attempts to make its assignments in a fashion that will provide to the population units the greatest economic benefit. If a boycott is established it is possible for the people to loose money or pay increased costs to the extent that the computer may have to search for a less attractive second choice to assign people to work or shop.

3. Allocation of Time

Whereas the voting procedure gives the social sector some control over the operations of the government sector, and the ability to boycott gives the social sector a degree of influence in the economic sector, the allocation of time is a decision that has many interactive effects.

The time which is allocatable is a worker's leisure time -- that time not spent in full-time work, eating, sleeping, or personal care. Leisure time is divided into 100 units which can be allocated to part-time work, adult education, political activity, or recreation.

However, allocatable time is decreased by the amount of time which it takes workers to travel to and from their place of employment. Therefore, the actual amount of time which can be allocated by you is 100 units minus time spent traveling to and from work. The number of time units consumed in traveling to and from work varies according to road types, transportation modes, and congestion, and distance traveled.

Allocatable time is further decreased if a population unit lives on a parcel having a high health index. A parcel's health index is a function of its pollution index, residential overcrowding, and the use index of the municipal service plant serving the parcel.

The following are the various possibilities for time allocation:

(1) Extra Work - the ability to augment income by working longer hours or at more than one job. There are only select areas which offer part-time employment opportunities; the School Department in the Government Sector and a few in the Economic Sector. Workers are paid in proportion to the amount of time they are able to work and in direct proportion to their salary.

If there is no part-time position available, population units will not gain extra employment. The unfulfilled requested time becomes involuntary leisure and adds to personal dissatisfaction.

(2) Education - Education in the model represents not only formal education but training (on the job and elsewhere). It is assumed that unless a certain amount of time is spent in keeping up skills and learning new techniques and information, the education-skill level of the population units declines relative to other population units. It is the level of this skill that largely determines the ability of population units to get better jobs -- in fact, it may determine the ability to get a job at all.

To provide for formal training, there is adult education. This education can be provided both on the public and private sector. The public education is free (the private, of course, is not).

If there is no adult education or not enough made available by the School Department, the time allocated to this use will be assigned to involuntary leisure time and add to personal dissatisfaction.

(3) Politics - the number of voters turning out for the election of a particular candidate, a poll, or a referenda, is normally determined as a random percentage of a population unit (varied by socio-economic class). This percentage can be positively influenced by the expenditure of greater amounts of time in political action. The influence is specific, in that the class of the population units which experience the increased turnout is the one which assigns the time to politics.

(4) Recreation - the amount of leisure time available positively affects the dissatisfaction of the population units. However, a decision to spend time in this fashion

requires the expenditure not only of time units but also the purchase of goods and services from PG and PS establishments. Remember that time allocation is a debit-credit concept. Population units start with 100 units of time to assign for population units of each class for each jurisdiction. Teams may estimate that 15 units of time are going to be consumed in the traveling to and from work and in sickness for their units. The PL's then only have 85 units of time left for other purposes. In studying the computer output for PL units, teams may discover that the PL's are not receiving enough income, so the team will allocate 40 units to extra employment. Further, because the education-skill level of those units also happens to be low, the team might allocate 25 units for public adult education. The PL's now have only 20 units left for politics and recreation. This 20 units may be divided between the two remaining alternatives.

After the computer run and the generation of a new round of output, the team may discover that it estimated incorrectly when calculating the time consumed in traveling to and from work and sickness. Because of increased congestion on the highways it took 30 units of time rather than 15. This means that the team allocated 15 units too few to travel and the computer program will subtract the difference from the less important time allocations of recreation and politics.

4. Cash Transfer

The only direct allocation of money allowed the social sector is the ability to transfer savings to any other social, economic, or government account. Such a transfer enters the receiver's general cash reserves; it is not earmarked by the program to be used in any particular manner. The transfer might be for the purpose of aiding a pollution abatement program. Or, a business forced by the government to close because of its pollution might be required to grant money to its unemployed workers. However it is used, the ability to transfer cash allows the social sector many possibilities for affecting other parts of the system.

5. Set the Dollar Value of a Time Unit Travelling to Work

The computer assigns all population units to modes of transportation to and from work on the basis of least cost. Least cost includes transportation charges per mile (which differ according to mode of transportation, type of road and amount of congestion) as well as the dollar value of time spent traveling. The social decision-maker is able to indicate the dollar value of one time unit consumer traveling to and from work for each of the classes which he represents. As the dollar value of a time unit spent travelling increases, the chances are that the computer will assign a more expensive but quicker mode of transportation to work (i.e., via automobile in almost all cases).

The following example will demonstrate how the computer considers the dollar value of time.

Let us say the transportation costs for one worker is $150 per year to get to work by bus and $230 to get to work by auto. It also requires an extra 4 time units to travel by bus instead of auto.

If the dollar value of time for that population unit was set at $40 (dollar value) or $310 to get to work by bus. To take auto it costs $320 (no extra time units consumed). Therefore, the computer would assign the population unit the BUS mode to travel to work (i.e., $310 is less than $320).

In the same case, suppose the dollar value of time was set to $50. Then the total bus cost would be $150 plus 4 time units times $50 (dollar value) or $350. Auto would cost only $320. Therefore, the computer would assign these population units the auto mode to work (i.e., $320 is less than $350).

B. Input Format

Local system decision-makers (such as the social sector teams) use a standardized input form (Figure SS-4) when making decisions that must be processed by the computer.

The standard message format is:

$CODE/ = dm/a, b, c, d, ...

1. $CODE stands for the type of decision code. The Social Sector has the option to make decisions that use the following decision codes:

$BYCT (boycott workers or shop locations)
$TIME (allocate time)
$CASH (transfer cash)
$VALUE (set the dollar value of a time unit travelling to work)

2. "=dm" is the decision-maker, which for the Social Sector is a double letter code (AA, BB, etc.).

3. The columns "a", "b", and so forth are filled in with the appropriate information depending upon the particular decision.

Note that there is a slash (/) after the decision code and after the decision-maker code. There are commas separating all other bits of information. Note also that the decision-maker code is prefaced by an equals sign (=).

Note on Time Allocation Decisions

It is important that jurisdiction-wide time allocation decisions precede parcel-specific time allocation decisions on the input forms submitted for computer processing. If a parcel-specified time allocation decision is followed by a jurisdiction-wide time allocation decision for the jurisdiction that contains the specified parcel, the jurisdiction-wide decision will override the previously input parcel-specific decision.

INPUT FORM

Note: When filling out this form, refer to input description form in the manual.

Please write clearly; distinguish between 1 (one) and "I" (eye), "Ø" (oh) and "0" (zero); be sure to fill in numbers exactly as required; omitting commas within numbers (100000).

RIVER BASIN MODEL

Decision Code	Decision-Maker	a	b	c	d	e	f	g	h	i	j	k
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____
$____ /	=____ /	____,	____,	____,	____,	____,	____,	____,	____,	____,	____,	____

SOCIAL DECISION-MAKERS: INPUT EXPLANATION FORM

Type of Decision	Code	Decision Maker	a	b	c	d	e	f	g
Allocate time by jurisdiction, by class	$TIME	AA, BB, CC, etc.	class (H M, or L) and jurisdiction (1, 2, or 3)	time units in extra work; if none, 0	time units in public adult education if none, 0	time units in private adult education; if none, 0	time units in politics; if none, 0	time units in recreation; if none, 0	
Allocate time by jurisdiction, by class, by parcel	$TIME	AA, BB CC, etc.	class (H, M, or L) and jurisdiction (1, 2, or 3)	time units in extra work; if none, 0	time units in public adult education if none	time units in adult education; if none, 0	time units in politics; if none, 0	time units in recreation; if none, 0	residence location
Boycott	$BYCT	AA, BB CC, etc.	S	class boycotting (H, M, or L)	function boycotted (Shop or Work)	location boycotted (0 if department)	Stop the boycott or Begin it	if applicable, department (SC, MS) and jurisdiction (1, 2, or 3)	

Type of Decision	Code	Decision Maker	a	b	c	d	e	f	g
Transfer cash	$CASH	AA, BB, CC, etc.	C	Receiver (economic or social decision-maker or department and jurisdiction)	amount (in dollars)	class giving	if social decision-maker receiving, class receiving (H, M, or L); if economic decision-maker receiving, PVT; if department receiving, CAPital or CURrent account	residence location of giver	if social decision-maker receiving, residence location of receiver; 0 for all else
Set the dollar value of a time unit spent travelling to work	$VALUE	AA,BB CC, etc.	class (H, M, or L)	dollar value of a time unit travelling					

C. Social Sector Sample Decisions

All social sector decisions are made by teams for a single class at a time. The social teams are able to make one type of systemwide decision (boycott), two types of jurisdictionwide decisions (vote and allocate time), and two types parcel-specific decisions (cash transfer and allocate time).

Boycott

1. The PM's controlled by social team AA are beginning a work boycott of the employer located on parcel 9630.

2. The PL's controlled by team FF are stopping their shopping boycott of the commercial establishment on parcel 10030.

3. The PH's controlled by team CC are beginning a work boycott of the School Department in Jurisdiction 3.

Time Allocation (Jurisdiction-wide)

4. Social team AA has all of its PM's in Jurisdiction 1 allocate 20 time units to an extra job, 30 to public adult education, none to private adult education, 25 to politics, and 10 to recreation. Note that the jurisdiction number must always be given.

Time Allocation (Parcel-specific)

5. Social team AA wishes to make the time allocation for its PM's on parcel 9436 (in Jurisdiction 1) different from that of all its other PM's in Jurisdiction 1. These specific PM's are to have an allocation of 0 for an extra job, 0 for both forms of education, 55 for politics, and 35 for recreation.

Cash Transfer

6. Social team AA makes a deal with social team FF whereby it transfers $15,000 from its PH's on parcel 9432 to the PL's of team FF on parcel 10032.

7. Social team BB gives $6500 to the School Department current account in Jurisdiction 3 from the account of its PM's on parcel 9836.

Set the dollar value of Time

8. Social team CC sets the dollar value of a time unit spent travelling to work at $20 for its low-income people.

SAMPLE DECISION INPUTS FOR THE SOCIAL SECTOR

Sample Decision	Decision Code	Decision-Maker	a	b	c	d	e	f	g
1.	$BYCT / =	AA /	S,	M,	W,	9630,	B,	____	
2.	$BYCT / =	FF /	S,	L,	S,	10030,	S,	____	
3.	$BYCT / =	CC /	S,	H,	W,	0,	B,	SC3	
4.	$TIME / =	AA /	M1,	20,	30,	0,	25,	10	
5.	$TIME / =	AA /	M1,	0,	0,	0,	55,	35,	9436
6	$CASH / =	AA /	C,	FF,	15000,	H,	L,	9432,	10032
7.	$CASH / =	BB /	C,	SC3,	6500,	M,	CUR,	9836	
	$VALUE / =	CC /	L,	20,	____,	____,	____,	____	

8. Social team CC sets the dollar value of a time unit spent travelling to work at $20 for its low income people.

V. Master Tables

A. Population Unit Master Table

	PH	PM	PL
General Characteristics			
Population	500	500	500
Workers	120	160	200
Students	130	140	100
Education Range	70-99	40-69	0-39
Registered Voters	200	140	100
Mobility Characteristics			
Selection of Movers			
Random Movers	7%	5%	1%
Most Dissatisfied	(Half of the 20% with highest Quality of Life Index)		
Percent of Unemployed	33	25	15
Percent of Under-employed	33	25	NA
Selection of Housing Criteria			
Housing QI Range Considered	71-100	40-100	20-70
Maximum Occupancy Considered	120%	120%	120%
Environment Index	(lowest index value is most preferred)		
Characteristics of In-Migrants from Outside			
Education Level	85	55	15
Voter Registration	200	140	100
Previous Saving	0	0	0
Time Allocation			
Extra Job	20	30	40
Public Adult Education	0	30	20
Private Adult Education	20	5	0
Politics	40	20	10
Recreation	10	10	20

Population Unit Master Table (Cont'd)

	PH	PM	PL
Income Characteristics			
Workers per Pl	120	160	200
Full Employment Salary	(salary per worker times number of workers)		
Part-time Salary	(80 time units provides full-time salary)		
Welfare	(Local jurisdiction payment per worker times the number of unemployed workers)		
Miscellaneous	(cash transfers from other accounts)		
Expenditure Characteristics			
Rent			
Rent Paid Factor	2.00	1.33	1.00
Space Units Consumed	2	1.5	1
Transportation			
Maximum Percent of Salary Willing to be Spent to get a Job			
Costs per Worker for Job	10%	15%	25%
Auto			
Base Auto Cost	$210	$190	$140
Cost per HY Link (uncongested)			
HY3	$100	$ 87	$ 75
HY2	$125	$112	$100
HY1	$150	$137	$125
Public Transit	(fare set by transit authority)		
Maximum Pl's per RR1	50	40	30
Maximum Pl's per BUS 1	25	20	15
Unit Public Transit Consumed	2	2.5	3.3

Population Unit Master Table (Cont'd)

	PH	PM	PL
Travel to PG (and to PS):			
Base Cost per CU	$50	$50	$50
Cost per CU Consumed (along HY3) (along HY2 is twice as much and along HY1 is three times as much)	$125	$125	$125
	(These commercial transportation costs are only incurred if purchases are made from local suppliers).		
Normal PG Consumption (CU's)	34	28	21
Additional CU's of PG for each time unit in recreation	.1	.05	.025
Normal PS Consumption (CU's)	16	11	7
Additional CU's of PS for each time unit in recreation	.075	.05	.0
Schooling of Children			
Criteria for Attending Public School			
Minimum School Value Ratio	80	60	None
Maximum Ratic of Students/ Teacher	18	22	None
Minimum Ratio of PH Teachers to PM	1.0	.75	None
Cost of Private Education (per full Pl)	$39,000	$24,500	$12,500
Cost Per Student	$300	$175	$125
Schooling of Adults			
Cost per Time Unit Allocated to Private Adult Education	$3000	$3000	N/A

Population Unit Master Table (Cont'd)

	PH	PM	PL
Health Expenditures (per P1)			
Base Amount	$8000	$4000	$2000
Coliform PARTS/MG greater than 100	$400/Part	$200/Part	$100/Part
Coliform PARTS/MG less than 100	$160/Part	$80/Part	$40/Part
Taxes			
Sales Tax			
State	(3% of the dollar amount of PG and PS purchases)		
Local	(depends upon the rates set by the local jurisdiction of PG and PS separately)		
Income Tax			
Federal (on salaries)	8%	4%	1%
Local	(set by the local jurisdictions)		
Automobile Taxes	(depends upon rates levied - jurisdiction of residence and/or work)		
Miscellaneous Expenses	(cash transfers to other accounts in the social, economic, or government sectors)		
Time Allocation (total time units)	100	100	100
Auto Transportation (uncongested)			
Per link HY3	2.5	2.5	2.5
Per link HY2	5.0	5.0	5.0
Per link HY1	7.5	7.5	7.5
Bus Transporatation			
Waiting	1	1	1
Along HY3	5.0	5.0	5.0
Along HY2	7.5	7.5	7.5
Along HY1	10.0	10.0	10.0
Rapid Rail Transportation	2.5	2.5	2.5
Waiting	1	1	1
Walking	2.5	2.5	2.5

Population Unit Master Table (Cont'd)

		PH	PM	PL
Illness	(health index for the parcel on which the P1's residence is located divided by 10)			
Extra Job	(80 units of part-time work is equivalent to a full-time job)			
Education				
Time Units Required to Maintain the Highest Level		32	24	30
Time Units Required to Maintain the Education Level Specified in the Parenthesis		16(80) 24(90) 32(99)	12(50) 18(60) 24(69)	12(10) 18(20) 24(30)
Typical Decline in Educational Level if No Time is Allocated for Adult Schooling		2	2	2
Allocation Typically Needed for Stay at Present Level		16	12	18
Politics - Units of Time Required to Increase Voter Registration:	(increases in voter registrations last for only one round)			
7%		10	10	10
10%		50	50	50
15%		60	60	60
Water Consumption (MG)				
Daily if living in:	RA	.08	.07	.03
	RB	.07	.05	.03
	RC	.06	.03	.02
Annually if living in:	RA	29	25	11
	RB	25	18	11
	RC	22	11	7

Population Unit Master Table (Cont'd)

Congested roads at peak-hours (all to work trips) cause an increase in the dollar and time costs of automobile usage. For example, a road that is 25% congested (utilized 125%) will cost 25% more in both money and time for those workers who use it.

B. Quality of Life Factors for Population Units

	PH	PM	PL
Health Index			
Maximum Value	100	100	100
Poor MS	(MS Use Index - 100) ÷ 4; Maximum =25		
Residence Crowding	(% Occupancy - 100) ÷ .8; Maximum =25		
Coliform Index	PARTS/MG ÷ 4; Maximum = 50		
Time Index			
Transportation Time Consumed			
AUTO - Waiting	0	0	0
HY3	2.5	2.5	2.5
HY2	5.0	5.0	5.0
HY1	7.5	7.5	7.5
BUS - Waiting	1	1	1
HY3	5.0	5.0	5.0
HY2	7.5	7.5	7.5
HY1	10.0	10.0	10.0
RAIL - Waiting, any level, Walking (per segment)	1	1	1
Recreation	(Maximum = 0, minimum = -100		
Involuntary	(Desired time in extra job and public adult education minus actual time in extra job and public adult education); Maximum = 100.		
Pollution Index	Value printed for that parcel of land on which the residence is located; Maximum = + 166; Minimum = -16.		
Neighborhood Index			
QI of Housing	100-QI	90-QI	70-QI
Rent	(Rent-$330,000)2	(Rent-$200,000)3	(Rent-$140,000)
MS Use Index	MS Use Index - 100; Maximum = 100		
School Use Index	School Use Index - 100; Maximum = 100		

Quality of Life Factors for Population Units (Cont'd)

	PH	PM	PL
Tax Rates in			
Local Jurisdiction			None
Each mil or resident income	.25	.25	
Each mil on goods	.25	.25	None
Each mil on services	.25	.25	None
Each mil on land	.125	.125	None
Each mil developments	.125	.125	
Welfare Payment			
For each $100 below $2000	None	None	4

Health Index + Time Index = Personal Index
Pollution Index = Neighborhood Index = Environment Index
Personal Index = Environment Index = Quality of Life Index

VI. Social Sector Strategies

A. GAINING A PERSPECTIVE ABOUT THE MODEL

In a sense, the range of formal Social Sector decisions is "limited" as compared to the Economic or government sectors. In addition, actions like strikes, boycotts and elections are not everyday things. Also, while the time allocation process is a powerful instrument, it may not have the same sustaining challenge as major economic or government decisions.

The real power, then, of the Social Sector can be developed through its influence on the goals, priorities, objectives, plans and actions of the other sectors. To exert this influence the social sector participants should do several things:

a. Acquire an understanding of the whole city (the local system).

b. Become involved in the very early rounds with the flow of action in all sectors.

Some of the ways in which these activities can be accomplished are listed below:

1. Use of maps. The social sector should make the maximum use of a variety of maps which lead to a confident understanding of the computer maps of the local system. For instance, a sequence of maps portraying a real city can be used to show such things as landforms, demographic data, geography, transportation patterns, social characteristic distribution and planning forms.

These maps can provide the graphic orientation to the abstraction of the model's computer maps.

The social sector should then spend time to examine and gain a familiarity with the model's 26 maps which are printed each round. These graphic portrayals depict the kind of comprehensive descriptions from which participants can acquire a "feel" for the physical characteristics of the region. This awareness can become the framework within which plans, priorities and objectives can be structured. In effect, this approach modifies the feeling of isolation, or detachment, which can affect the social sector in the early rounds.

Equipped with this perspective of the whole region, the Social Sector should, from the very beginning, set out

to develop their own positions on plans, priorities and objectives for the region. Even though this sector may not have direct decision power on such things, for instance, as spending of money, patterns of development and zoning they are all major activities which affect people - and as such are of direct interest to the Social Sector.

It is important then, that the Social Sector reach out, beyond the stated boundaries of its formal decision-making, to gain information and establish a presence in the activities of the whole model.

Some examples of things which may be of specific interest to the Social Sector - even though activating decisions are made in other sectors - are:

(a) housing development for mixed-income groups
(b) full time and part time jobs
(c) improved bus routes
(d) increased parklands
(e) more available adult education
(f) improved local water quality

B. ESTABLISHING A JOINT EFFORT

As in real life, the people (social sector) are frequently "neglected" until an election or a massive boycott takes place. The nature of this neglect can range from courteous indifference to premeditated contempt.

To counter this general condition, and the concurrent feeling of frustration at the inability to effect change, the social sector can, and should, develop some forms of liaison, caucus or consortium of interest.

While there can be many forms of joint venture, which are analagous to real life situations, it should not be assumed that these are automatic or easy to establish. The record of community action groups, for instance, reflects the difficulties of establishing common interests, developing effective leadership, gaining agreement on goals and creating sustained organizational strength. It may be that ad hoc relationships have the best chance of survival and accomplishment.

A prerequisite condition of all group ventures is the discussion, examination and hammering out of some form of goals, priorities and plans. These need not be fixed in concrete but must be identified. Some of the possible social sector alliances which have proved to be effective are listed with some comments on their purposes.

(a) Income Group Caucus. It may be useful, for some limited purposes, for members of high, middle or low income groups to join together to establish positions or strategies in their own exclusive interests.

(b) Geographic Alliances. In both stable and dynamic situations there are many conditions (such as poor transportation services, industrial impacts, school conditions, environmental deficiencies) which seem to suggest the need for a "community" alliance of all income level residents. To be effective in influencing change in one section, it is likely that trade offs relating to the whole region will be involved and sectional, or geographical groups, should be prepared to respond to these.

(c) Social Sector Bloc. While the social sector is construed as one component of the model, it is usually apparent that interests of the various income groups are different, uncommon and competitive. Inter-class hostility is not unusual, especially if one or more income groups are aggressive, demanding or hostile.

It is possible, however, with articulate leadership and some common causes, for the whole social sector to establish a people's bloc devoted to common goals or objectives such as housing, education or minimum salaries.

In this case, social sector participants must be prepared to make short-run concessions and sacrifices in the interest of long-term gains for the whole social sector (the people).

For example, a social sector bloc, which had hammered out a priority interest in good quality housing for all income groups, could bring pressures on the government to establish a Housing Coordinator with responsibility and power to intercede in Economic Sector residential decisions.

A social sector bloc could also arrange with a favored, or responsive, businessman (Economic Sector) for a consortium effort in the development of residences. The social sector could make funds available to this business venture through cash transfers.

C. THE ART AND SCIENCE OF NEGOTIATION

Among the rewarding aspects of participating in the Social Sector are the knowledge and skills acquired in the techniques of advocacy and negotiation.

Whether operating independently, or as a group, it is essential that social sector participants know their own situation well and have effective information about their "adversaries". i.e., they must do their homework and "come prepared".

In the early rounds there is either a reluctance to negotiate from limited strength, or a tendency, among social sector participants, to assume that their needs and interests will be easily recognizable and accepted by economic and government decision-makers.

The Social Sector decision-maker should initially assume that the interests of other sectors, and other decision-makers, will not coincide with his own and may well be contrary.

While the social sector may be interested in lower rents and higher salaries, the controlling businessman may be interested in maximizing profits through higher rents and lower salaries. A more subtle difference can occur in the differing news about quality housing. A businessman may conclude, through cost-benefit analysis, that his best move is to demolish low income housing which the social sector would like to have upgraded or restored.

Social consciousness should be assumed to be a sometime strategy for businessmen and most governments. (It occasionally happens, in a gaming situation, that altruism comes easier than reality dictates.)

The Social Sector, then, should be prepared to face hard-nosed bargaining, deception, indifference and failure. Anticipating these conditions, it is important that as much information as possible be assembled - within the time available - that requests and demands be accompanied by trade-off positions; that agreements be sealed in writing on decision forms; that extra support and pressures be lined up for additional bargaining power if needed; that the "threat" of economic or political pressure be made apparent at strategic times. If negotiations fail, more work should be done in strengthening the presentation.

For example, if the Social Sector chooses to accuse a mayor (or government) of failing to move a city forward in the areas of income or the quality of housing or efficient public transit, it should be prepared to address such things as: dissatisfaction trends, growth rates, salary indices and trends, relative costs of auto and bus transportation, changing housing quality indices, news construction, patterns of development or growth, business conditions and taxes and assessment policies and rates.

Having done this research and analysis from available information, the social sector could assume that a mayor would be:

(a) defensive
(b) interested in staying in office.

A mayor in this situation may attempt to "all the things he has accomplished" and away from the deficiencies of his administration. By hanging tough on the issues (based on homework analyses) and avoiding the diversionary rhetoric, the social sector can force the light to be shed on their interests and the heat to be directed toward the mayor and his interest in staying in office.

In dealing with the Economic Sector, the Social decision-makers should acquire as much business intelligence as possible pertaining to profits, favorable tax rates, assessment patterns, subsidies, wage and price trends. They can use the leverage of their political power to influence the economic sector.

All of these actions are beyond the formal decision process but within the implied nature of the Social Sector and consistent with the individual interests, talents and experiences of social decision-makers.

D. DECISIONS: GENERAL TO SPECIFIC

An interesting aspect of the Social Sector is the spectrum of responsibility each decision-maker has in representing, or reflecting the intents of, population units (people). This spectrum can range from a specific location (9032) with one population unit (500 people) to a whole population class (PH, PM, PL) of thousands of people living in many square miles of the region.

One of the ways the model extends the thinking of participants is through this population, or people, concept. The social sector participant has the opportunity to represent, or reflect, the interests of whole classes of people, or people, for example, in small geographic communities, who may be in debt, unemployed, underemployed, affluent, urban, suburban, rural, satisfied or dissatisfied.

In the early stages, the Social Sector decision-maker will probably concentrate on decisions affecting whole classes of people (High PH, Middle PM, or Low PL). The concerns will be primarily with financial status, satisfaction trends, education and employment characteristics. While the research to make decisions will be related to specific locations, the analysis, at this stage, should probably involve whole classes, or all the people the decision-maker represents.

In the process, it is very useful for each decision-maker to identify (color code), on an Economic Status Map, the locations at which his people live, work and shop and the routes travelled to work and shops. Then three characteristics give the Social Decision-Maker an excellent fix on his people and their major physical relationships in the local system.

Following these general approaches the Social Decision-Maker will be doing the following things in the early rounds:

(a) Identifying and establishing a sense of the physical community in which he is involved.

(b) Building a set of personalized objectives, goals and priorities for the community.

(c) Establishing a list of objectives and priorities for the class(es) of people he represents.

(d) Establishing a set of objectives and priorities for individual locations of people.

There is no "one way" to make decisions in any of the sectors. The above outline is "one" way, designed to facilitate the early involvement of social decision-makers and to extend this involvement into all aspects of the model operation.

When the decision-maker has the feel for the extensive interactions which are influencing his status, he can very readily concentrate on the research and analysis in employment, transportation, housing, education relationships, income and expense relationships which are basic to improving the condition of population units at individual locations. In addition, working from general to specific understandings can enable the social decision-maker to establish the most effective liaisons and alliances with other participants.

Labor Unions are a good example. It will not take very long for social decision-makers to identify, or isolate, those employers (Economic Sector) who seem to be operating in an indifferent manner toward employees. At this point discussions and liaisons, across income class lines, can easily lead to a pattern of union organization designed to serve the best interests of employees.

The opportunities to examine and measure the complexities and subtleties of social conflicts, as a social decision-maker, are innumerable. Housing concepts, for instance, force the issues of both geographical and income level mixes and require analyses, contemplation and judgements i.e. decisions.

Working from the general to the specific may be analagous to looking at a city as a whole or looking at a neighborhood; or may be like generalizing about urban issues as compared to taking specific actions.

E. THE EXERCISE OF POWER

There is no doubt that acquiring, exercising and maintaining power - political and economic - is an appealing aspect of gaming, as it is in the real world.

An interesting aspect of this model is the power relationships. The government and economic sectors both start with a considerable degree of open power. The Social Sector, on the other hand, has latent power, which must be actively pursued to be effective.

The Social Sector has the decision option to boycott shops or work (strike). This is frequently an effective method, to achieve desired changes in prices or wages. An equally effective exercise of power can be the threat of boycott or strike.

While a shopping boycott hurts a businessman, it also requires the consumer (Social Sector) to purchase required goods and services elsewhere at higher costs; while a work boycott (strike) hurts a businessman's production and income, it may also cause the striker (Social Sector) to be without income for a year. Actual boycotts, then, may have certain counter-productive characteristics.

For the artful gamesman the exercise of power may be conducted through the threat of boycott. The threat, delivered to the Economic Sector, with confidence, courage and skill may achieve the objectives without cost to the Social Sector, except for preparation and time. Timing is important as is the degree of support which the Social Sector decision-maker can count on in his behalf.

A businessman (Economic Sector) who is in the process of upgrading, expanding or developing his business activities at considerable expense is very vulnerable to the threat of a boycott or strike which will decimate his income from a year. A threat may include very extensive support from social decision-makers who may be reluctant to actually boycott.

In the exercise of political power a whole range of options are available to the Social Sector, from the single request to the government sector for assistance to the ultimate power play of "taking over" the government through the electoral process.

In most cases of negotiation it is probably appropriate for the social sector to assume that the government will be non-responsive, patronizing or deceptive at the same time that there exists a desire to retain power.

Working from these assumptions the Social Sector can apply pressure in a range from gentle reminder of its political power, to the threat of political reprisal to the actual call for an election and the ultimate act of voting a favored candidate into office.

The threat of action need not be political extortion, rather it can be a forceful persuasion concerning the source and the sharing of the exercise of political power.

APPENDIX A

Sequence of Computer Print-Out

Although sections of the computer output can be distributed in any order and in any combination to players, it is printed in a fixed order with which the director should become familiar. The overall order of output is:

1. Migration
2. Water System
3. Employment
4. Commercial Allocation
5. Social Sector
6. Economic Sector
7. Social and Economic Summaries
8. Government Detail
9. Summary Statistics
10. Maps

Within each of these major output sections there are several subsections. An additional section of print-out results from the processing of decisions on a data base. That print-out, called EDIT, has no fixed sequence within it; the order of decision input is the order in which EDIT processes and lists player and director decisions. The EDIT print-out is separate from the print-outs listed above. These print-outs reflect the simulated region's status in response to the previous year's data base and any changes made to it through EDIT.

Each subsection of output has its own title, but on every subsection the heading for the data base and the round number are printed. A list of the titles of print-out sections in the order in which they are printed and a description of each are given below and are summarized in Figure 4.

Print-Out Section	Description
1. Migration	
Environmental Indexes	For each class which can live on each residence parcel, this shows the value of each component of the environmental index based on last round's pollution index, MS use index and school use index and this round's residence quality, rent, tax rates, and welfare rates.

Figure 4

RIVER BASIN MODEL OUTPUT

1. Migration
   - 1.1 Environmental Indexes
   - 1.2 Personal Indexes
   - 1.3 Dissatisfaction Cutoffs
   - 1.4 Migration Detail
   - 1.5 Migration Statistics
   - 1.6 Migration Summary

2. Water System
   - 2.1 Water User Effluent Content
   - 2.2 River Quality During Surface Water Process
   - 2.3 Water User Costs and Consumption
   - 2.4 Coliform and Pollution Index Values

3. Employment
   - 3.1 Employment Selection Information for PL Class
   - 3.2 Employment Selection Information for PM Class
   - 3.3 Employment Selection Information for PH Class
   - 3.4 Part-Time Work Allocation for PH Class
   - 3.5 Part-Time Work Allocation for PM Class
   - 3.6 Part-Time Work Allocation for PL Class
   - 3.7 Employment Summary

4. Commercial Allocation
   - 4.1 Personal Goods Allocation Summary
   - 4.2 Personal Services Allocation Summary
   - 4.3 Business Goods Allocation Summary
   - 4.4 Business Services Allocation Summary
   - 4.5 Government Contracts
   - 4.6 Terminal Demand and Supply Table
   - 4.7 Terminal Allocation Map

5. Social Sector
   - 5.1 Dollar Value of Time
   - 5.2 Social Decision-Maker Output
   - 5.3 Social Boycotts

6. Economic Sector
   - 6.1 Farm Output
   - 6.2 Residence Output
   - 6.3 Basic Industry Output
   - 6.4 Commercial Output
   - 6.5 Economic Boycott Status
   - 6.6 New Construction Table
   - 6.7 Land Summary
   - 6.8 Loan Statement
   - 6.9 Financial Summary

7. Social and Economic Summaries
   - 7.1 Number of Levels of Economic Activity Controlled by Teams
   - 7.2 Employment Centers
   - 7.3 Economic Control Summary for Teams
   - 7.4 Social Control Summary for Teams
   - 7.5 Social Control Summary Totals
   - 7.6 Economic Graphs for Teams
   - 7.7 Social Graphs for Teams

8. Government Detail
   - 8.1 Assessment Report
   - 8.2 Water Department Reports
   - 8.3 Sampling Station Report: Point Source Quality
   - 8.4 Sampling Station Report: Ambient Quality
   - 8.5 Utility Department Report
   - 8.6 Utility Department Finances
   - 8.7 Municipal Services Department Report
   - 8.8 Municipal Services Department Finances
   - 8.9 Municipal Services Department Construction Table
   - 8.10 Planning and Zoning Department Report
   - 8.11 School Department Report
   - 8.12 School Department Finances
   - 8.13 School Department Construction Table
   - 8.14 Highway Department Finances
   - 8.15 Highway Department Construction Table
   - 8.16 Rail Company Report
   - 8.17 Bus Company Report
   - 8.18 Chairman Department Finances
   - 8.19 Tax Summary
   - 8.20 Financial Summary

9. Summary Statistics
   - 9.1 Demographic and Economic Statistics

10. Maps
   - 10.1 Personal Goods Allocation Map
   - 10.2 Personal Services Allocation Map
   - 10.3 Business Commercial Allocation Map
   - 10.4 Municipal Service Map
   - 10.5 School Map
   - 10.6 Utility Map
   - 10.7 Water Usage Map
   - 10.8 Water Quality Map
   - 10.9 Municipal Treatment
   - 10.10 Municipal Intake and Outflow Point Map
   - 10.11 Surface Water Map
   - 10.12 Farm Runoff Map
   - 10.13 River Basin Flood Plain Map
   - 10.14 Farm Map
   - 10.15 Farm Assessed and Market Value Map
   - 10.16 Market Value Map
   - 10.17 Assessed Value Map
   - 10.18 Economic Status Map
   - 10.19 Highway Map
   - 10.20 Planning and Zoning Map
   - 10.21 Parkland Usage Map
   - 10.22 Socio-Economic Distribution Map
   - 10.23 Demographic Map
   - 10.24 Social Decision-Maker Map
   - 10.25 Topographical Restriction Map
   - 10.26 Government Status Map

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Print-Out Section	Description
Personal Indexes	For each class living on each residence parcel, this shows the value of each component of the personal index based on last round's time allocation, residential crowding, MS use index, and coliform bacteria index.
Migration Detail	For each residence parcel and for each class which lived on the parcel immediately before or after the migration program ran, this shows the number of Pl's in the class now residing on the parcel and of those who moved, why they moved and where they came from and went to.
Migration Statistics	Number of in-migrants, out-migrants, internal migrants, and natural population growth by jurisdiction and class.
Migration Summary	The number of Pl's who moved between or within jurisdictions by class, by jurisdiction and by reason for moving.

2. Water System

Water User Effluent Content	For each economic activity and municipal water system, the volume of effluent dumped into the surface water and the amount of each pollutant in the effluent after the effluent has received any treatment.
River Quality During Surface Water Process	For each of the five stages in the surface water process and for the surface water on each parcel through which a river flows, this shows the water quality rating, the volume of water, and the amount of each pollutant present.

Print-Out Section	Description
Water User Costs and Consumption	This shows for each economic activity the amount of water which it required, the amount which it obtained from its normal source and the cost which it paid to purchase water, to treat its intake water, to recycle water and to treat its effluent.
Coliform and Pollution Index Values	Map showing, for each parcel containing surface water, the coliform count and the water quality rating. The pollution indexes for such parcels and for parcels bordering parcels containing surface water are also shown.

3. Employment

Employment Selection Information for Low-Income Class	Tabular output showing the place of residence of all Pl's, their employers, the number of Pl's not employed and employed by each employer, the salary of each employer, the time units consumed in transportation to work, the cost of using an auto to go to work, the costs using a bus and/or rail to go to work, and the route used to travel to work whether by auto or public transit.
Employment Selection Information for Middle Income Class	Tabular output showing the place of residence of all Pl's, their employers, the number of Pl's not employed and employed by each employer, the salary of each employer, the time units consumed in transportation to work, the cost of using an auto to go to work, the costs using a bus and/or rail to go to work, and the routes used to travel to work whether by auto or public transit.

Print-Out Section	Description
Employment Selection Information For High Income Class	Tabular output showing the place of residence of all Pl's, their employers, the number of Pl's not employed and employed by each employer, the salary of each employer, the time units consumed in transportation to work, the cost of using an auto to go to work, the costs using a bus and/or rail to go to work, and the routes used to travel to work whether by auto or public transit.
Part-Time Work Allocation For High Income Class	Tabular list of residence location of part-time workers, their employers, the number of part-time units spent working, and the yearly salary rate.
Part-Time Work Allocation for Middle Income Class	Tabular list of residence location of part-time workers, their employers, the number of part-time time units spent working and the yearly salary rate.
Part-Time Work Allocation for Low Income Class	Tabular list of residence location of part-time workers, their employers, the number of part-time time units spent working and the yearly salary rate.
Employment Summary	Information by class and total for the number of Pl's employed at their design level or at lower levels, the number unemployed, the total number of Pl's, the part-time units worked, and the number of jobs full time that were not filled by the local labor force.

4. Commercial Allocation

Personal Goods Allocation Summary	Tabular output showing the identification number assigned to each PG establishment, its

Print-Out Section	Description
	location, owner, level, effective capacity, actual capacity used, price, and gross sales. For each customer it shows the store to which it is assigned, the customer location and type or class, the customer's owner, the consumption units (including those for maintenance and recreation), transportation costs (shadow costs in the case of residences) the purchase cost (total cost in the case of residences), and total cost.
Personal Services Allocation Summary	This is identical in format to the Personal Goods Allocation Summary but gives details regarding personal services.
Business Goods Allocation Summary	For businesses which require business goods, the format is the same as for personal goods. In addition, there is a section called Government Contracts which shows, for each school and MS department, how many consumption units it purchases from each business goods establishment.
Business Services Allocation Summary	This is identical in format to the Business Goods Allocation Summary but gives details regarding business services.
Terminal Allocation Summary	Tabular list of the location, business type (land use), and terminal requirements of each terminal user. Each terminal is assigned an identification number and its location, level, and usage are noted.

Print-Out Section	Description
Terminal Allocation Map	Map showing the code number of the terminal to which each terminal user in the local system is assigned.
5. Social Sector*	
Dollar Value of Time	This table shows, by team and by class, the dollar value of a time unit spent in travel.
Social Decision-Maker Output	By jurisdiction, by social decision-maker, and by class, a table in which each social characteristic is a row and each residence parcel is a column. The characteristics are descriptive and financial.
Social Boycotts	Detail on who is boycotting, what function they are boycotting, and similar details about social boycotts appear on this output.
6. Economic Sector**	
Farm Output	Tabular list, one row per farm, showing the farm code number, farm type, number of parcels comprising the farm, number of percents of parcels comprising the farm, the farm's fertilizer level, normal income, actual income, land taxes, and total net income.

*The dollar value of time prints a table for each jurisdiction, although at this time the value is set for a team and class without regard to jurisdiction. The rest of the social detail prints in order of jurisdiction number, within that in alphabetical order, and within that in order of class (low first, high last). Output for any classes which a team does not control in a jurisdiction is not printed. Likewise, a class having no boycotts receives no boycott output.

**The economic output prints by team in alphabetical order. All of a single team's output is printed before the next team's output begins. A team for which a section of output is irrelevant does not receive that section of output. For example, a team with no residences receives no residence output. Likewise, a team which has no loans outstanding as either a debtor or a creditor does not receive a loan summary. All active teams receive financial summaries.

Print-Out Section	Description
Residence Output	Tabular list of descriptive and financial information about each residence parcel which the decision-maker controls.
Business Output	Tabular list of descriptive and financial information about each business which the decision-maker controls. All basic industries are grouped together and precede the group of personal commercial and business commercial.
Construction Industry Output	Tabular list of descriptive and financial information about each construction industry which the decision-maker controls.
Construction Industries' Contract Table	Description of all contracts made by construction industries controlled by the decision-maker.
Economic Boycott Status	Detail on all boycotts in which the decision-maker is either the party boycotting or the party being boycotted.
New Construction Table	Detail on all construction contracts in which the decision-maker is the contractee.
Land Summary	Tabular list of the location of parcels owned by a team, their assessed value, percent that is undeveloped and private, the taxes on undeveloped land, the percent publicly developed and undeveloped, the percent undevelopable because of topographical constraints, the utility capacity available and used.

Print-Out Section	Description
Loan Statement	Tabular list showing borrower, lender, interest rate, years remaining on the loan, the original principal, and the annual payment.
Financial Summary	A cash flow statement showing expenditures and income, a portfolio of conservative and speculative stocks, a balance sheet of assets and liabilities, and the amount which the decision-maker can borrow.

7. Social and Economic Summaries

Number of Levels of Economic Activity Controlled by Teams	A table listing the number of levels of each economic activity controlled by each team.
Employment Centers	Table showing the locations, number of job openings, number of Pl's hired, and salaries offered by Federal-State Employers; table showing, for each local government employer, the location of its employment center.
Economic Control Summary*	For each non-farm economic activity, this table shows its location, type and operating level of activity, production index (0-100) or occupancy rate (0-120), net income, and rate of return.

*This table prints for each economic team in alphabetical order.

Print-Out Section	Description
Social Control Summary*	For each class living on each parcel controlled by a single two-letter social decision-maker, this table shows the residence location, class, gross income per worker, family savings and total dissatisfaction (quality of life index).
Social Control Summary	By jurisdiction and by class, the number of Pl's controlled by each social decision-maker.
Economic Control Summary	This prints two graphs for each economic decision-maker, in alphabetical order. The first is, for up to ten rounds, the average net income from the team's economic activities each round, expressed as a ratio of the first round's net income. The second is a ten-round history of the average rate-of-return of the team's economic activities, expressed as a percent.
Social Control Summary	This prints two graphs for each social decision-maker, in alphabetical order. The first is a ten-round history of the average net income earned by each class which the team has controlled. The second is a ten-round history of the average quality-of-life index of each class which the team has controlled.

*This table prints for each social decision-maker in alphabetical order.

Print-Out Section	Description
8. Government Detail*	
Assessment Report	List of assessment ratios, special assessments and other policies set by the Assessor.
Water Department Reports	List of intake and outflow treatment plant locations, levels, types, capacities, operating costs, volume treated, income, intake and outflow point locations, prices charged to municipal water users, pollutant concentration in municipal effluent (for those districts which are sampled).
Sampling Station Report: Point Source Quality	For those economic activities whose effluent is sampled by the local government, this shows the volume of effluent and the concentration of each pollutant after any treatment.
Sampling Station Report: Ambient Quality	For any parcel on which the jurisdiction measures the quality of the surface water leaving the parcel, this output shows the concentration of each pollutant.
Utility Department Report	Tabular list of utility plants, their location, level, units installed from each plant, units served, total operating costs per unit, and income derived from charges. Also listed is the charge per utility unit to customers, undeveloped land and outstanding bonds.

*A department's output is printed for all jurisdictions before the next department's output is printed.

Print-Out Section	Description
Utility Department Finances	Summary of all current and capital revenues, expenditures, and new balances.
Municipal Services Department Report	Tabular list of MS locations, maintenance levels, value ratios, effective capacities, loading (units of capacity used), number PL and PM's working, and the MS use indexes. Also shown are the salary levels, contracts to purchase BG and BS, the locations of undeveloped land, and outstanding bonds.
Municipal Services Department Finances	Summary of all current and capital revenues, expenditures, and new balances.
Municipal Services Department Construction Table	For each MS construction or demolition, this shows the location of the construction firm, the MS location, the status of construction, the old and new level of the MS, the contracted price, the maintenance level, and the number of PL's and PM's assigned to work at the MS.
Planning and Zoning Department Report	Total jurisdiction population, total amount of parkland, outstanding bonds, and capital revenues, expenditures, and new balance.
School Department Report	Tabular data on school unit locations, levels, maintenance levels, value ratios, students attending, teachers, student-teacher ratios, and use indexes. Also data on undeveloped land, BG and BS contracts and cost of purchases, adult education summary, and several summary school statistics.
School Department Finances	Summary of all current and capital revenues, expenditures, and new balances.

Print-Out Section	Description
School Department Construction Table	For each school construction or demolition, this shows the location of the construction firm, the school building location, the status of construction, the old and new level of the school, the contracted price, the amount of federal-state aid used, the maintenance level for the school, and the number of PM's and PH's assigned to work at the School.
Highway Department Report	A financial report showing capital and current expenditures and revenues, outstanding bonds, a summary of maintenance levels and expenditures by road type, a summary of road conditions, a terminal status report, a list of undeveloped land, and a status report on available federal-state aid.
Highway Department Construction Table	For each road or terminal construction or demolition, this shows the construction firm, the location of the road or terminal, the status, the old and new level, the contracted price, and the dollar amount of federal-state aid used.
Rail Company Report	A financial report showing capital and current revenues and expenditures, outstanding bonds, employment costs, the amount and condition of rolling stock, the fare structure, passengers and total fares by route, and the number of passengers using each segment of each route.

Print-Out Section	Description
Bus Company Report	A financial report showing capital and current revenues and expenditures, outstanding bonds, employment costs, the amount and condition of rolling stock, the fare structure, passengers and total fares by route, and the number of passengers using each segment of each route.
Chairman Department Finances	This shows the welfare payment per unemployed worker and the financial summaries for municipal services, schools, highways, planning and zoning, utilities, and the chairman's account. Also included are the Chairman's outstanding bonds.
Tax Summary	Tabular list showing by the eight types of local tax bases, the dollar amount of the tax base, the tax rate, and the revenue generated.
Financial Summary	Tabular list, for each department, of current and capital appropriations, federal-state aid, total revenue, total expenditures and final surplus or deficit.
9. Summary Statistics	
Demographic and Economic Statistics	Tabular list by jurisdiction of population and its characteristics, land usage, housing, employment, earnings, income from the national economy, outflows to the national system, and national business cycle effects.

Print-Out Section	Description
10. Maps	
Personal Goods Allocation Map	Map showing the locations and code numbers of all personal goods establishments, locations of all PG users, and the code number of the PG to which each PG user is assigned.
Personal Services Allocation Map	Map showing the locations and code numbers of all personal services establishments, locations of all PS users, and the code number of the PS to which each PS user is assigned.
Business Commercial Allocation Map	Map showing the locations and code numbers of all business goods and business services establishments, locations of all BG and BS users, and the code numbers of the BG and BS to which each BG and BS user is assigned.
Municipal Service Map	Map showing the locations of MS's and their districts, the locations of economic activities, the number of MS units drained by each economic activity and MS use indexes.
School Map	Map showing the locations of schools and their districts, school use indexes, and the number of children on each residence parcel attending public and private schools.
Utility Map	Map showing the locations of utility plants and their districts, the number of utility units installed on each parcel, and the number of utility units drained on each parcel.

Print-Out Section	Description
Water Usage Map	Map showing the locations of economic activities, the percent recycling at basic industries, and the type and level of basic industries' effluent treatment plants.
Water Quality Map	Map showing the locations of economic activities, the surface water quality on those parcels having surface water, and the pollutant which caused the water quality rating.
Municipal Treatment Plant Map	Map showing locations, types and levels of municipal intake and outflow treatment plants.
Municipal Intake and Outflow Point Map	Map showing locations of municipal intake and outflow points and the utility districts which they serve.
Surface Water Map	Map showing, for each parcel having surface water, the volume of water on the parcel, its rate of flow, and the percent of the surface area of the parcel consumed by water.
Farm Funoff Map	Map showing for each farm its type and where its runoff flows into the surface water.
River Basin Flood Plain Map	Map showing the locations of river basins, the dam priority of each river basin, and the flood susceptibility of each parcel in the river basin.
Farm Map	Map showing the location of each farm, its owner, its code number, the percent of each farm parcel which is in farm use, the type of farm, and its fertilizer level.

Print-Out Section	Description
Farm Assessed and Market Value Map	Map showing, for each farm parcel, its assessed and market value and the percent of the parcel which is in farmland.
Market Value Map	Map showing, for each privately-owned non-farm parcel, the market value of 100% of the land, the market value of the privately-owned buildings, and the total market value of the privately-owned land and buildings.
Assessed Value Map	Map showing, for each privately-owned non-farm parcel, the assessed value of the privately-owned land, the assessed value of the privately-owned buildings, and the total assessed value of the privately-owned land and buildings.
Economic Status Map	Map showing the economic sector owner of each privately-owned non-farm parcel, its zoning, the type and level of economic activity, the level of utilities installed, and, for every parcel, the percent of the parcel which is privately-owned and undeveloped.
Highway Map	Map showing the locations and types of roads and terminals and the locations, types, and levels of non-farm economic activities.
Planning and Zoning Map	Map showing the zoning classification of those parcels which are zoned, the percent of each parcel which is parkland, and the percent of each parcel which is public institutional land.

Print-Out Section	Description
Parkland Usage Map	Map showing the percent of each parcel which is in parkland or public institutional use, the population served by the park, and the park's use index.
Socio-Economic Distribution Map	Map showing, for each residential parcel, the type and level of housing and the number of Pl's in each class living there.
Demographic Map	Map showing the population (in 100's), percent occupancy, and quality index (QI) for all residential parcels, and the value ratio (VR) for all private non-residential developments.
Social Decision-Maker Map	Map showing, for each class living on a residential parcel, the social decision-maker which controls the class on that parcel.
Topographical Restriction Map	Map showing the percent of each parcel which is undevelopable due to topographical or other restrictions (e.g., mountains or military bases).
Government Status Map	Map showing the locations and levels of schools, municipal services, utility plants, roads, and terminals.

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